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ECONOMIC EVALUATIONS OF FOREST LAND MANAGEMENT ALTERNATIVES IN SMALL AREAS

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Economic Evaluations of Forest Land Management Alternatives in Small Areas

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INTRODUCTION

The Forest Service, in 1971, committed itself to and embarked on a course of change in its planning and decision making process. This change is in part a result of the new legal mandate provided by the National Environmental Policy Act of 1969 (NEPA).

NEPA, Section 102, (A), (B), and (G) directed all agencies of the Federal Government to: (1)

(1) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment;

(2) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by Title II of this Act, which will insure that presently unqualified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations;

(3) Initiate and utilize ecological information in the planning and development of resource-oriented projects.....

NEPA also mandated in Section 103 that:

> All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act.....

As an attempt to comply with the letter and intent of NEPA, the Forest Service has established a new planning process, referred to as Land Use Planning (FSM 8200), which attempts to merge the requirements of NEPA with the older Forest Service Multiple Use Planning process.

Prior to 1971, there were two levels of planning for Forest Service Lands, the Region and the Ranger District. At the Regional level, a Regional Multiple Use Management Guide was prepared "to establish a pattern of multiple use managment for National Forest Lands in the Region". (2) The District Ranger

Multiple Use Plans covered management decisions and delineated specific management areas under the direction and coordination requirements established in the Regional Guide. These two documents were developed under broad coordinating instructions that were developed at the Chief's level.

Under the new Land Use Planning process (FSM 8200), the basic levels of planning are necessarily much the same as previously established under Multiple Use (FSM 2100) so as to conform with the hierarchical structure of authority of the Forest Service. The following is the sequence followed in the development of planning direction and plans: (3)

> At the top of the hierarchy is the planning direction issued by the Chief. This direction is included in Framework for the Future, Environmental Program for the Future, the Program Budget, and the Chief's Annual Program and Work Planning Advice.
>
> The second level in the hierarchy of planning direction is the direction issued by Regional Foresters. These documents include Area Guides and the Regional budget and work planning advice.
>
> The third level in the hierarchy of planning direction and plans is at the National Forest level. Here the Forest Supervisor must combine the planning direction received from the Regional Supervisor with specific information about the National Forest. The product is the Forest Land Use Plan which serves to direct and coordinate further planning on the Forest as well as the uses and activities carried on within the Forest on a day-to-day basis.
>
> The fourth level of land use planning is planning for units of land smaller in size than a National Forest. Directed and guided by the Forest Land Use Plan, Unit Plans are made as needed to intensify the planning and resultant decisions for this smaller area. Unit Plans must assure that plan decisions are compatible with National, Regional, and local factors.

The focus of this report is primarily with this fourth level in the planning hierarchy, Unit Planning, and is concerned with the other levels only to the extent that they serve as guidelines.

Since the Unit Plan is the basic management and action document of the new Forest Service planning system providing "a focus for planning activities in a small enough area to be workable and large enough to enable the planning

team to envision or predict the cause and effect relationships of management alternatives", [4] this is the level at which land use allocations between alternative uses is actually made. In this sense, it supersedes the discretionary authority of the District Ranger to allocate and manage land areas under the old District Ranger Multiple Use Planning Process.

In retrospect, Land Use Planning is a new approach in Forest Service Planning. While some of its elements are found in the old Multiple Use Plans, including for example the hierarchical structure of the process and, as will be discussed later, the basic planning objectives, some basic concepts of this new process, including emphasis on public involvement and contribution, interdisciplinary planning teams, and ecosystem planning, are new.

This report, prepared as a cooperative research effort between the U.S. Forest Service and the Center for Resource Management Studies, College of Forest Resources, University of Washington is an overview study of the use of economic analysis in the Unit Planning Process. It attempts to focus on both the legal and procedural requirements for economic analysis as well as the problems and potential for further improvements in integrating economic analysis into the planning process.

Part One reviews the various legal and administrative mandates for planning with respect to guidance for economic analysis. This includes both Federal legislation and agency administrative policy.

Part Two outlines an economic interpretation of the land use allocation problem and focuses on defining the analytical components of economic theory that will hopefully clarify the planning process. A distinction is drawn between allocative efficiency considerations and distribution or equity factors as they relate to small area land use decisions.

Part Three summarizes the significant factors revealed in this analysis and attempts to carefully identify and define major problems in the use of economic analysis in connection with small area forest land management planning. Finally, several recommendations are drawn for further research efforts which may extend the usefulness of traditional economic analysis for planning purposes.

PART I

REQUIREMENTS FOR ECONOMIC ANALYSIS

Prior to analyzing the legal and regulatory requirements of the Forest Service for economic analysis in small area planning, consideration is first given to the role and relevance of economic analysis in public allocation decisions in order to clarify some misconceptions which permeate this field.

Economics is the science of how a particular society solves its economic problems where economic problems are defined as problems of constrained choice. That is, an economic problem exists whenever scarce resources are used to satisfy alternative competing ends. If the means are not scarce, there is no economic problem. If the means are scarce, but there is only a single end, the problem of how to use the resources is a technical, not an economic problem. However, where the means are scarce, and the ends are varied, which is the case with most of the land use allocation problems faced by the Forest Service in small area planning and decision making, choices are implied among these alternative ends and the problem is an economic one.

Economic analysis is not merely concerned with money. It is instead concerned with the ultimate value of limited resources of all kinds. Economists seem to give particular attention to money simply because it is the common denominator our society uses to measure the relative marginal or incremental value of the vast majority of its resources. This attention to money has given rise to much unnecessary and irrelevant condemnation of the role of economic analysis in contemporary natural resource allocation problems. Many critics of economic analysis argue that it does not and therefore can not take into account the non-pecuniary aspects of these problems and is therefore inadequate.[5]

The error of this logic stems from the association of economic analysis with only a market allocation of resources and therefore the assumed irrelevance of economic analysis to non-market (and non-pecuniary) allocations. This leads to development of artificial definitions in an attempt to distinguish between so called "economic" and "non-economic" goods.

However, as mentioned before, any problem of allocating scarce resources among alternative uses is an economic problem regardless of the allocation scheme employed, market or non-market, private or public. Therefore, if a conceptual difference exists, it must rest on the fact that certain resources or outputs simply do not pass through the market in order to have a pecuniary marginal value placed on them. Thus, for example, a more relevant distinction might be made between "market or commodity" and "non-market or non-commodity" goods. To suggest that because a resource does not have a market (pecuniary) value attached to it, it is therefore non-economic, is to ignore the tremendous influence of environmental resources in modern economic analysis. Non-market goods, for example clean air and quiet surroundings, are certainly just as "economic" as a sheet of plywood because of scarcity, alternative uses of the resources employed to provide them, and their user value. As with market goods, the values attached to these goods are related to demand and supply. We simply need to recognize this fact and to seek satisfactory surrogate indicators to guide our allocation process. This is not an easily accomplished task as is noted throughout the balance of this report. However, to assume that scarce resources can be efficiently allocated by a system of non-economic criteria begs the issues involved. In this instance, focus on inputs to the planning process tend to predominate, often characterized by strong advocacy processes. Such a situation can only hinder the search for better use of forest resources.

National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA)[6] is perhaps the most significant legislation calling for economic analysis because of its impact on the planning methodology of the Forest Service.

In the Act, both direct and indirect reference is given for economic analysis requirements.

Section 102(2) states:

> The Congress authorizes and directs that, to the fullest extent possible: .... (2) all agencies of the Federal Government shall -
>
> (A) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment; and
>
> (B) Identify and develop methods and procedures,.....which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations; (emphasis added)

Direct reference to economic considerations in section 102(2)(B) suggests a somewhat narrow interpretation of applicability. It implies the commodity or pecuniary aspects of economic consideration.

However, a clear, if indirect, reference is implied to economic analysis when the act calls for "methods and procedures...which will insure that... environmental amenities and values be given appropriate consideration along with economic and technical consideration". This is, in essence, recognition of broader aspects of resource allocation as an economic problem. For example, questions related to the extent that the scarce resources of the Forest Service should be allocated to the production of environmental amenities as opposed to economic goods raise fundamental economic problems.

However, the concept of "appropriate consideration" as specified in NEPA, is difficult to define. Interpretations may range from the view that

an agency cannot act without exhaustive attempts to avoid the impacts, to the view that the agency decision maker must simply be aware of the impact his decisions may have.(7) However, since the enactment of NEPA, litigation has resulted in several court interpretations of this concept.

Court Interpretations

The court in Calvert Cliffs(8) defined the concept of "appropriate consideration" in terms of a "balancing" or trading off of the environmental factors of a proposed action against the pecuniary economic and technical ones. Relying primarily on sections 102(2)(A) and (B), the court found that "NEPA mandates a rather finely tuned and systematic balancing analysis". As the court more fully explained:

> NEPA mandates a case by case balancing judgement on the part of federal agencies....The particular economic and technical benefits of a planned action must be assessed and then weighted against the environmental costs, alternatives must be considered which would affect the balance of values...The point of the individual balancing analysis is to insure...that the optimally beneficial action is finally taken.

The court further states that:

> ...if the decision was reached procedurally without individualized consideration and balancing...it is the responsibility of the courts to reverse.

Therefore, the details of the manner in which an agency conducts its final decision making process will be subject to close judicial scrutiny under NEPA. However, such review would be limited, in the Calvert Cliffs view, to whether the decision was arbitrary or clearly gave insufficient weights to environmental values.

Other court cases approve the Calvert Cliffs view that agencies must actually consider environmental factors and that such consideration is judicially reviewable, although they have not added significantly to interpreting the balancing process.(9)

The court's endorsement of the balancing approach in Calvert Cliffs meant at the very least that the agencies have to comply in earnest with Congress' intent to affect final agency decision making. What the endorsement meant beyond that is doubtful. The court avoided detailed consideration of how the balancing should be carried out or of how the kinds of techniques described in sections 102(2) (A) and (B) might be developed and used. The agencies' obligations, if any, to be specific about how incommensurable costs and benefits were traded off or how weights were assigned to both quantifiable and unquantifiable factors, were not discussed.

Similarly, the court in Sierra Club vs Froehlke[10] stated:

> What is of deep concern (in analysing the balancing aspects of the case) is the absence of definitive guidelines, procedures, and common denominator terms to be used in quantifying and comparing environmental values with other values.

Council on Environmental Quality Guidelines

In a Council on Environmental Quality (CEQ) memorandum to federal agencies regarding procedures for improving environmental impact statements CEQ confirms that federal agencies have an implied duty to balance advantages and disadvantages of a proposed action.[11] The memorandum states:

> Inherent in the duty imposed on any agency by NEPA to promote environmental quality is the obligation to weigh the possible environmental effects of a proposal against the effects on other public values the agency is mandated to consider. If the environmental effects are adverse, the agency must consider whether they outwiegh the benefits of the proposal in deciding whether to go ahead. This implicit requirement is confirmed by the directive of (NEPA) Section 120(2) (B)....

Again, however, in similar fashion to the court interpretations, this memorandum does not specifically indicate procedures by which the balancing process is to be done.

Also, the "Preparation of Environmental Impact Statement Guidelines" issued by the CEQ sheds little light on the issue of how the mandated balancing process is to be done, but implies that it is the concern of the individual agencies to develop procedures. It states:[12]

> Agencies will continue to access their experience in the implementation of the Section 102(2) (C) (Section of NEPA requiring impact statements) and in conforming to these guidelines and report thereon to the Council by June 30, 1974. Such reports shall also indicate what progress the agency has made in developing substantive criteria and guidance for Making environmental accessments as required by...Section 102(2) (B) of the Act.

Agency Guidelines - Manual

The guidelines issued by the Forest Service for Land Use Planning (FSM 8200), revised to be "in accord with NEPA"[13], also reveal direct and indirect reference to the requirement of economic analysis.

In the direct sense it refers, as did NEPA, to the market (pecuniary) aspects of the environment.[14]

In an indirect reference to economic analysis, the Manual (8200) states:[15]

> Appropriate methods for evaluating benefits, costs, and trade-offs will be used for estimating the consequences of each alternative plan. An analysis and evaluation of the benefits and costs will provide a basis for the Forest Service and others to make judgements as to the beneficial and adverse effects of alternative plans. It will provide the rationale for adoption of a plan that insures the greatest public benefits.

The Manual further states:[16]

> The choice is developed through a reasonable and rational analysis of how the available resources can be most efficiently managed to achieve optimum multibenefits for the American people.

This clearly, although not explicitly, requires economic analysis since economic analysis is by its very nature an "appropriate method" for the resolution of these economic problems: those involving the allocation of scarce resources among alternative uses.

Perhaps the most obvious implication for this broader interpretation of the required economic analysis is revealed in that section of the Forest Service Manual pertaining to Environmental Impact Statements. In the specific section dealing with the purpose of such statements (FSM 8402), the Manual states:

> The objective of an envirnmental statement is to provide a means for giving environmental quality careful and appropriate consideration in the planning and decision making process...This means environmental quality must be objectively weighed with economic development and social well-being goals over both the short and long run....In addition to other economic information available, benefit-cost information or other specific economic analysis should be included with the environmental statement....

In all of the legal and regulatory requirements cited for Forest Service small area planning, explicit reference is given to the requirement of economic analysis in a somewhat narrow sense by specifically mentioning the requirement of considering what is referred to as economic (implying market valued) goods as an important element in planning and decision-making.

Also, however, all of the legal and regulatory requirements cited implicitly require the utilization of a broader interpretation of economic analysis through reference to the requirement to analyze trade-offs, or a balancing process of the consequences of proposed actions and alternatives. Even though not specifically stated as such, except perhaps in that portion of the FSM (8402) dealing with the purpose of impact statements, the fact remains that these trade-offs or balancing problems are essentially economic problems of the allocation of scarce resources among alternative uses. Therefore, the interpretation of the requirement of what is referred to as "appropriate consideration", "appropriate techniques of comparing", and objective "weighing" processes in dealing with these problems is within the realm of economic theory.

PART II

ECONOMIC INTERPRETATION OF SMALL AREA PLANNING

Introduction

The analysis of small area land use planning decisions can be viewed as a specialized case of production economics. That is, the Forest Service acts in its capacity as a resource manager to control the flow of goods and services from its lands. It is intimately involved in decision-making not only with regard to the array of outputs to be provided and their distribution among society but also with the selection of productive inputs to be employed and the scope or scale of activity consistent with aggregate economic welfare. Although the tasks of forest management are traditionally viewed with regard to technical production goals, the broader aspects of economic decision-making are critical to the ultimate success in using resources, including both the land and timber as well as labor and capital, more effectively and efficiently.

The economic interpretation of small area planning can be viewed as a set of three interrelated considerations: 1) definition of objectives, 2) production economics, and 3) distributive or equity impacts of management decisions. Each of these considerations is explored in the remaining sections of this Part.

Planning Objectives

A goal, or objective, is some special set of conditions, a state of being, an end, or an object to be achieved sometime in the future or maintained over a given period of time. Goals are a prerequisite for decisions and provide decision-makers with targets. In the simplest decision-making situations involving a choice among a variety of possible courses of action (or inaction), the actual objective of the enterprise serves as the criterion of success. That is, the only valid basis for adopting a particular course of action is that it will achieve the objective more effectively than any other course of action.

If performance is judged by any other criteria, the selected course of action, however efficient, will not achieve the objectives. Also, if objectives are subject to differing interpretation or are ambiguous, selected courses of action may be expected to be controversial and also subject to misinterpretation. Thus, it is a prerequisite of economic decision-making that the objectives should be carefully considered and clearly stated.(17)

Searching for overall goals and objectives which serve as a basis for land use planning in the Forest Service is difficult. First, one must consider the enabling legislation of the Forest Service to determine if Congressionally mandated goals exist and, if so, what they are. Second, one must consider internal Forest Service policies and regulations in accord with the hierarchical levels of management and authority.(18) Thirdly, in addition to this internal hierarchy, one must also recognize that the Forest Service is a subunit of the Federal Government and therefore is subject to the mandated goals of the public sector in general.

The planning process has as its objective the accomplishment of premeditated goals and is primarily concerned with providing technical information for decision-making and for plan implementation and control.(19) As stated in the F.S. Manual:(20)

> The Forest Service land use planning system is structured to identify, measure, evaluate, and coordinate overlapping and interdependent ecological, social, and economic systems in order to facilitate meeting (the agencies') objectives.

The manual further states:(21)

> In order to achieve the objectives....the guiding principles of multiple-use and sustained yield as defined in the Act of June 4, 1960 are the basis upon which the planning considerations and decisions for National Forest Land Use Planning will be predicted. Planning decisions, activities, and subsequent actions will be in accord with NEPA of 1969. Other legislation and regulations of the Secretary of Agriculture will be followed as they apply.

Therefore, the best way to identify specific planning objectives is to look at the actual and implied objectives as specified in the enabling legislation of the Forest Service as well as resulting policies and regulatory requirements.

In general, the purpose of a society in establishing policies about what its members do is to assure that their actions will contribute as much as possible toward some ends which that society deems desirable. Before the society can intelligently establish such policies, it must have a clear idea of the ends of the actions it wishes to attain. It also must understand the possible effects on these ends of the actions which it seeks to control through the policies.(22)

A policy is thus a means to some end or ends, and its effectiveness can only be judged in terms of those ends. However, many of the ends toward which policies are aimed are desirable only because they in turn become one of a number of alternative means toward the achievement of other ends. For example, a society may have an objective of adequate wood supplies for all consumer needs.(23) It therefore establishes a policy of increasing the growth of timber in its forests. One alternative way of doing this is to reduce the occurrence and severity of wild forest fires. A second objective thus arises of keeping forest fire damage to a minimum. In order to do this, a policy may be established of suppressing immediately all wild fires that are discovered. But, if this policy is to be effective, it is necessary that the fires be discovered. So a further objective exists of discovering all wild fires as soon as possible. As a means of achieving this, the designated forestry organization may put into effect a policy of manning all lookout towers on every day when the burning index is above some stipulated figure.

This example shows that in many cases there will be a hierarchy of policies as a result of the chain of ends and means.(23) For society, the objective

is to have an adequate supply of wood;[24] for the tower watchmen, it is to discover all wild fires. The two are linked together, however, and policies about manning towers are essential if broader policies about growing timber are to be made effective. Therefore, in order to measure the value or effectiveness of any given policy, it may be necessary to look beyond its own immediate ends.

The objectives of forest policies of the U.S.F.S., as evidenced in its legislative mandates and administrative directives are often not clearly stated and probably, in many cases, are not even clearly known. The logical process of reasoning from ends to means in the development of these policies may not have been undertaken.

As a result of this ambiguity, some critics of the Forest Service claim that all past legislation simply adds up to confusion in terms of goals or objectives and, therefore, the agency is left to interpret its own goals and objectives.[25] Others believe however, that a goal (or goals) is stipulated and can be discerned in the legislation.[26]

As an example of the latter, Alston interprets the legislative mandate to require the Forest Service to "maximize the total weighted value of the National Forests, always keeping in mind the requirement that all of the renewable resources are to be managed on a sustained yield basis without impairment of the productivity of the land"[27] and continues in his presentation to develop a decision model by which the agency can maximize this total weighted value.[28]

It should also be noted, however, that even if one accepts this interpretation as the overriding goal of the Forest Service itself, that as a public agency it may be subject to the mandated goals of the public sector in general. For example, Gardiner[29] states that ideally, decision making in

the public sector has as its general objective improvements in human welfare. Human welfare, however, has many components and so public decision making must take place in a multiple objective framework. These multiple objectives may include improvements in allocative efficiency, a more equitable distribution of income, regional development, full employment, price level stability, growth, maintenance of an exchange rate, gains in environmental quality, and other social or cultural gains. Clearly, management of our National Forests effect these general goals of the entire public sector as well as those specifically mandated to the Forest Service in particular.

With such a multiplicity of goals, goal conflicts are likely to occur. If for example, in evaluating alternative Forest Service allocation decisions, emphasis is placed on a more equitable income distribution, the result may be a smaller increase in consumption than possible if allocative efficiency had been the major objective.[30]

> The long run goal of the public sector must be to have the overall pattern of its decisions accurately reflect society's relative weightings of the various objectives in its multiple objective framework. In the short-run there will be divergences. No one decision can contribute to all objectives, nor is necessary for it to do so. Rather, all short-run decisions need to be placed in the context of the desired overall pattern, and evaluated in terms of their contributions to it.

It should be noted that this same view is expressed in that section of the Forest Service Manual dealing with plan selection. It states:[31]

> The choice (Plan Selection) is developed through a reasonable and rational analysis of how the available resources can be most efficiently managed to achieve optimum multibenefits for the American people. The process includes full consideration of the priorities and preferences expressed by the public at all levels affected by the plan.

The analysis of the problems of multiple-objective management and the evaluation of program performance has undoubtedly been limited by the implicit view that all decisions or actions must contribute to all objectives. Alston[32]

states that this is perhaps the underlying cause of many of the resource allocation problems facing the Forest Service to date. That is, that a lack of clear-cut priorities or weightings of goals makes it impossible to rationally decide among alternatives since goals serve as the basis for criteria for evaluating success. Worrell[33] also raises this point in considering the goals of public forestry in general. Gardiner[34] raises it in considering the goals of the public sector in general.

Whatever the goal or goals of the Forest Service are believed or interpreted to be, one overriding concept permeates the diverse literature on the subject of the goals of the Forest Service in particular and policy goals in general. Goals or objectives that are to be served by an agency must be clearly identified as a prerequisite to rational policy formation and resource decision making.[35]

For example, in the "Proceedings of a Conference on Multiple-Use of Southern Forests", Lloyd states:[36]

> Much confusion and contention can be avoided by specifying the goals and objectives before looking for or comparing alternatives. Effective problem analysis requires specification of the goals. This is especially important for multiple-use situations where there likely will be more than one set of goals, some of which may be in conflict.

A primary consideration prerequisite to effective economic analysis of small area planning is to develop a clear statement of analytical goals to guide Forest Service management and planning decisions.

In February 1970, Chief Cliff issued to all Forest Service personnel a pamphlet titled "Framework for the Future", dealing with the objectives and policy guides of the agency. The statement attempted to provide[37]

> a new framework to help guide our thinking and decision-making throughout the service...(and) identify the general scope and character of the role the Forest Service should play in the society of today and tomorrow.

Objectives are statedly not listed by priority. The document recognized that[38]

> There is a hierarchy of objectives, policies, and goals at each major level of the Forest Service's organizational structure. The interrelationships among various objectives and policies must be an integral part of decision-making at all organizational levels, ranging from the most all encompassing, long-range planning, to identification of specific targets of immediate concern.

The objectives as listed in "Framework for the Future" are

(a) Promote and achieve a pattern of natural resource uses that will best meet the needs of people now and in the future.

(b) Protect and improve the quality of air, water, soil, and natural beauty.

(c) Help protect and improve the quality of the open space environment in urban and community space.

(d) Generate forestry opportunities to accelerate rural community growth.

(e) Encourage the growth and development of forestry-based enterprises that readily respond to consumer's changing needs.

(f) Seek optimum forest land ownership patterns.

(g) Improve the welfare of underprivileged members of society.

(h) Involve the public in forestry policy and program formulation.

(i) Encourage the development of forestry throughout the world.

(j) Expand public understanding of environmental conservation.

(k) Develop and make available a firm scientific base for the advancement of forestry.

This list of "objectives" does not fulfill the analytical requirements for actual decision-making. As Alston[39] points out:

> The list in "Framework for the Future" is simply a group of statements on program scope and methods of goal achievement. They do not represent goals themselves, except perhaps for "a" and "b", which are so broad that they lack real meaning.

However, it may be argued that, at this level of the agency hierarchy, the objectives must necessarily be broad and therefore somewhat ambiguous due to the diverse nature of the resources managed, and consequently, the diverse nature of policies and objectives at the lower levels of the hierarchy so as to not unduly limit this diversity.

However, upon examination of the objectives stated at the lowest level of the planning hierarchy relevant to this paper, the Unit Plan, and the one in which would expect to find explicit statements of goals, one again is faced with analytical ambiguity.

For example, the management objectives for the Salmon River Unit Plan are stated as:[40]

(a) No single dominant use should be designated for the entire unit.

(b) The resources in the Salmon River Corridor from its confluence with the South Fork to its confluence with Ghost Creek should be managed in such a manner that future classification under the National Wild and Scenic Rivers Act will be possible.

(c) A native cutthroat trout population should be maintained in some portion of the planning unit.

(d) Any plan for the Salmon River must be coordinated and inter-related with all adjacent planning agencies, and the Roaring River planning unit.

(e) An acceptable level of forest fuels should be maintained to assure a constant degree of fire protection.

(f) Some portions of the unit should remain roadless.

(g) Roads and trails should be constructed and managed so as to enable man to enjoy a variety of uses in the unit.

(h) The primary value of all varieties of animal life in the Salmon River Planning Unit is for observation and study rather than for harvest.

(i) Timber harvest should be an integral part of the management of this unit.

(j) The emphasis on recreation development should be toward day use.

(k) All life forms in this unit are recognized as important and the management of man's activities should be planned to maintain the habitat required for their continued existence.

(l) Livestock grazing should be continued and used as a management tool in appropriate areas.

Again, as was the case in "Framework for the Future", there is no explicit statement of goals, but instead simply a group of statements on program scope and selected methods of goal achievement. A major deficiency in arriving at an economic interpretation is, therefore, a lack of a clear goal to be accomplished by the planning process. As has been noted, however, the legal and administrative guidelines can be read to implicitly mandate a goal of economic efficiency in resource use and management, to be constrained perhaps by specific overriding social goals where expressly stated by legislative direction.

Production Economics

Production theory is fundamental to an understanding of micro-economics. It is based on the physical and biological relationships underlying the allocation of economic resources. When physical or biological relationships are known, and marginal values for inputs and outputs are known, it is possible to calculate economic optimums - that is, the mix of outputs and levels of production that will make the most efficient use of inputs and yield the highest net economic value.

Maximization of net economic value is often equated with maximizing net dollar revenues in a market context.[41] Where markets function reasonably well, this identity may be adequate in defining economic efficiency. That is, market prices reasonably reflect true marginal cost of resources used and marginal value of goods and services produced. Where no market exists, or functions imperfectly, maximizing dollar net revenues will not maximize

net economic value. It should be noted that this is entirely consistent with the language of the Multiple-Use Sustained Yield Act of 1960. The Act states in part:

> ...with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output....

For purposes of this discussion, the objective of economic analysis should be interpreted in its broad context of value and not solely as market revenue.

If we approach a production problem such as the use of particular forest land from the point of view of an owner or manager and accept the assumption that the objective is to maximize net economic value, production economic theory can help guide decisions on:

(1) What outputs to produce,

(2) How much of each output to produce, and

(3) The best combination and level of inputs to use.

It should be noted that the forest manager, working within the overall economic environment, will be concerned with economic efficiency - getting the most out of the resources he has to work with. Some resource owners or managers seek the highest possible net returns for their efforts and investments. They seek an economic optimum which is obtained by maximizing net revenues from a given set of land, labor, and capital resources. Others, including public managers, may not have maximum net revenue as a primary objective. However, all public managers must operate within some limits of economic efficiency.[42]

Conceptually, value maximization from the use of resources in the public sector is governed by the same economic concepts as in the market place, although direct measures of the relevant variables is much more difficult in the absence of market transactions.

The application of production economics as a framework for evaluating small area land use management plans is applicable in the case of Forest Service management recognizing:[43]

(1) The management is concerned with publicly rather than privately owned resources,

(2) Other management objectives may conflict with maximizing net economic values,

(3) The market system doesn't operate for some of the goods and services produced, and

(4) The objective of maximizing net economic value has not been explicitly recognized as applicable to management of public lands.

A basic concept in production economics is that of the production function. This is merely an expression of biological or physical relationships in terms of resource inputs and production outputs. When producing a single product (such as timber) with a set of fixed resources or inputs (such as land), the production function indicates how output of that product responds to increasing amounts of a variable input (such as labor or capital).

It can be shown that efficient economic decisions can be made only with a reasonable knowledge of the position and shape of such production relationships. Knowledge of the production function makes it possible to select the most profitable level of production. Unfortunately, very little biological research has been designed to yield specific data that will help define economic production functions in the forest resources area. For example, research to determine responses to fertilization, thinning, or other practices often results in only two or three points and a determination of whether the differences among them are statistically significant.[44]

However, as will be evidenced later, in order to make intelligent resource allocation decisions, it is necessary first to have a sound knowledge of what goods and services can be produced using available resources and the response of output to varying levels of investment (addition of variable inputs).[45]

Discussion of most forest production output relationships has been in terms of a single product. In reality, however, management of forest resources seldom, if ever, yields a single output. Rather, multiple outputs normally result, in spite of whether the resources are intentionally managed for multiple products. Multiple products are often simply unintended consequence of single product management. Clearly, if economics is to be applied to small area land use decisions, the framework must be expanded to permit recognition of multiple outputs and their interdependent production relationship.

As long as products are produced by entirely separate processes, no special problems arise from the previous discussion. Analysis can be made by usual techniques, but using two separate production functions. Important cases, however, arise when the same production facility - in the forestry case, the same land area - is used to produce two or more products. This is the case of "joint" production, so called because at least one of the factors is "jointly" used in the production of two or more outputs.

The essential conceptual features of the economic analysis of the "joint" product case, however, follow easily from the development of the single product case. For example, suppose a land manager has an area suited to the production of timber and forage.[46] Assuming that the techniques for producing both products are established and available to the land manager (i.e. assuming that the production functions for each product are

known), the problem is simply that of deciding whether to produce timber, forage, or some particular combination of the two from the given area. The land area may thus be taken as the fixed factor.(47)

A graph can be constructed with quantity of timber scaled along one axis and quantity of forage along the other. Any combination of these two products can be represented by a single point. In Figure 1, for example, A represents one combination of timber and forage and B another combination. Point C represents a third combination where no investment in management is made. If there is resource management, it can be assumed that additional costs will be incurred.(48)

In Figure 2, a few of the infinite number of possible timber-forage combinations are shown, with the height of the column showing production costs.. By connecting all of the columns of equal height (in effect, by constructing a contour map of Figure 2) a set of curves similar to the lines in Figure 3 can be generated. Each curve represents the various combinations of outputs of timber and forage that can be generated on a particular land area at some level of cost. These output relationships are often referred

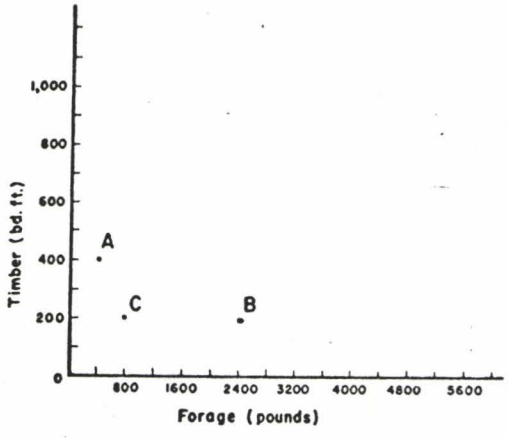

Figure 1: Any possible output combination of two products can be plotted on a diagram of this type.

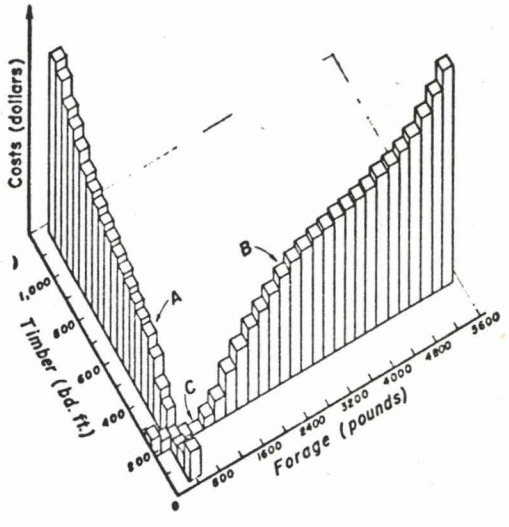

Figure 2: Costs may be indicated by the height of a column above a plane.

Reproduced from G. Robinson Gregory, "An Economic Approach to Multiple Use", Forest Science, Vo. (1), March 1955

to as "iso-cost" curves. The "iso-cost" curve is, the case of the Forest Service, a function of the level of the budget appropriated. Therefore, at some fixed budget level, consideration is given only to that one corresponding "iso-cost" curve. In this case the iso-cost curve is often referred to as the production possibility frontier.

Production functions and optimal mixture determinations in the multiple product case become more complex since the relationships between two products may vary. That is, two products may be either supplementary, complementary, or competitive.(49)

The relationship between two products is considered to be supplementary if the output of one of them can be increased (or decreased) without affecting the output of the other (Figure 4). For example, it may be possible to increase timber production without increasing or decreasing stream flow.

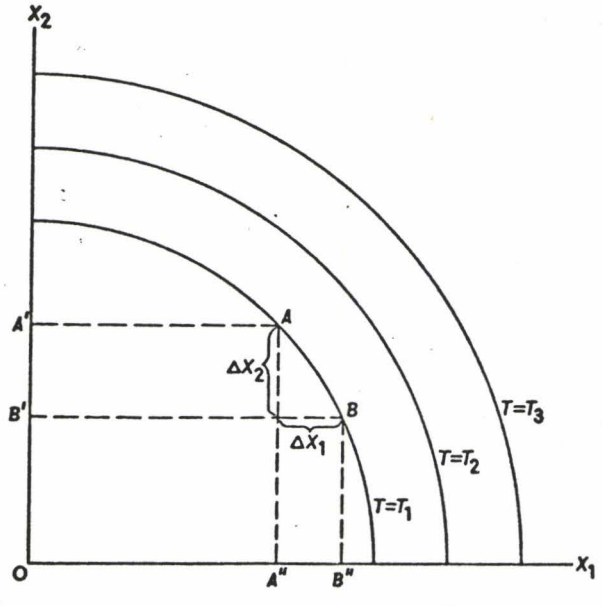

Figure 3: Iso-cost Curves (T) identify all product combinations that can be produced at equal cost.

(Reproduced from H. H. Liebhafsky, The Nature of Price Theory, The Dorsey Press, Inc. 1963, p. 166.

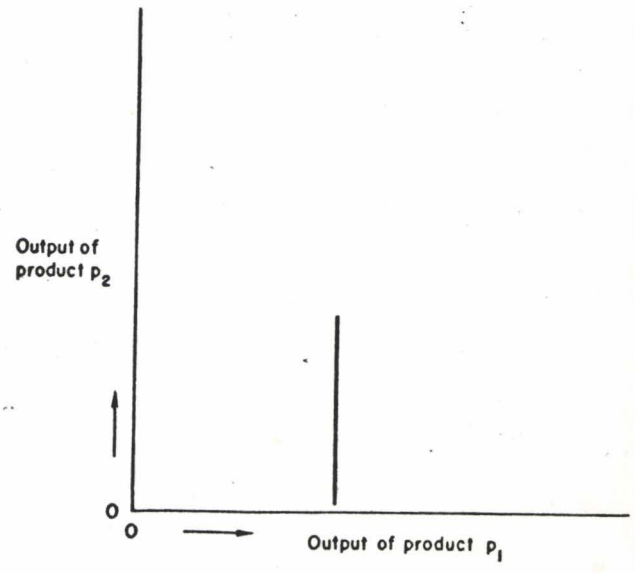

Figure 4: A supplementary relationship between two products.

(From Lloyd, "Economics of Multiple-Use", Proceedings, Conference on Multiple Use of Southern Forests, Pine Mountain, Georgia, Nov. 1969)

Two products are said to be complementary in production if management to increase (decrease) one also results in an increase (decrease) in the output of the other (Figure 5). For example, the growing of timber may also result in jointly producing a certain amount of wildlife, scenery, watershed regulation, or forage.

A competitive product-product relationship exists if an increase in the output of one product can be obtained only by giving up some of the other product. This implies that the uses result in a substitution or "tradeoff" of one use for the other. This relationship is characteristic of many of the multiple uses of forest resources and gives rise to most of the allocation problems facing public forest managers.

Figure 6 illustrates a special case in which the two products substitute for one another at a constant rate. This implies that the marginal rate of substitution of one good for the other is constant. Each additional amount of one product requires foregoing a constant amount of the other.

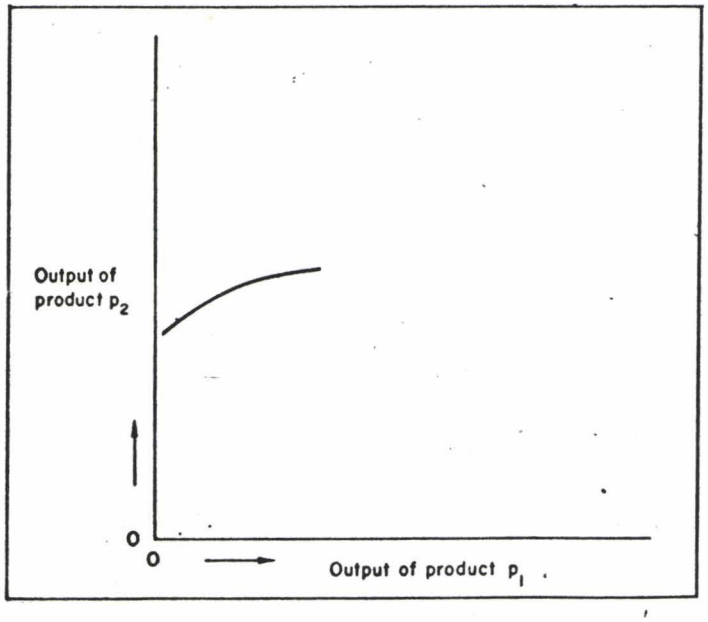

Figure 6: A Complementary Relationship Between Two Products

Reproduced from R. Duane Lloyd, "Economics of Multiple Use", Proceedings, Conference on Multiple Use of Southern Forests, Pine Mountain, Georgia, Nov. 1969

Determination of the optimal economic solution includes consideration of the marginal values of the respective units. That is, the economic solution is at that combination where the marginal rate of substitution is equal to the ratio of the marginal values of the two products. Where market transactions are utilized to allocate resources among alternative uses, the ratio of the marginal values of the two products is assumed to be the ratio of the prices of the products.(50)

Typically, the marginal rate of substitution is not constant but rather is variable as shown in Figure 7. In this case, an economic optimum can be obtained only by producing some of both products when both outputs have positive marginal values. The exact output combination will be determined by equating the marginal rate of substitution with the ratio of the marginal values of the two products.

It is likely that many multiple uses and products of the forest have complementary, supplementary, and competitive product-product relationships over different ranges of output as depicted in Figure 8. Situations of this type present the forest manager with opportunities for increasing production by taking advantage of the supplementary and complimentary portions of the relationships. It should be noted, however, that economic optimization usually involves marginal tradeoffs between alternative products and therefore, the economic optimum will be somewhere along the competitive portion of the curve.(51)

The above framework for analysis of production decisions assumes some fixed budget level. If management objectives however are to maximize net economic value, consideration must also be given to varying the budget level. With iso-cost relationships and the ratio of the marginal values, for a set of two products, the task of isolating the optimal combination

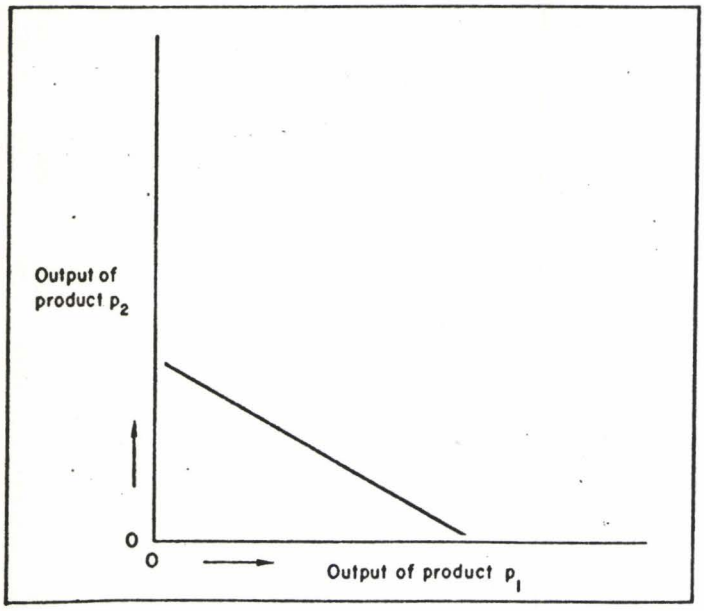

Figure 6: A competitive relationship between two products with a constant rate of substitution.

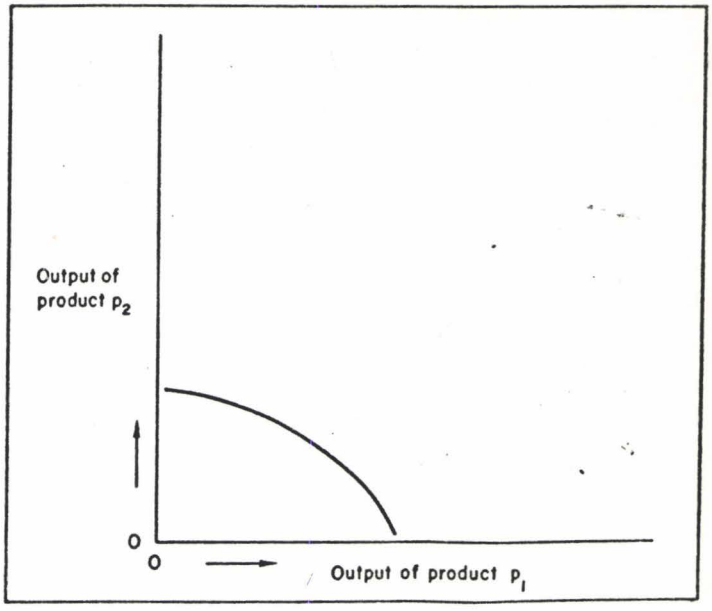

Figure 7: A competitive relationship between two products with variable rates of substitution.

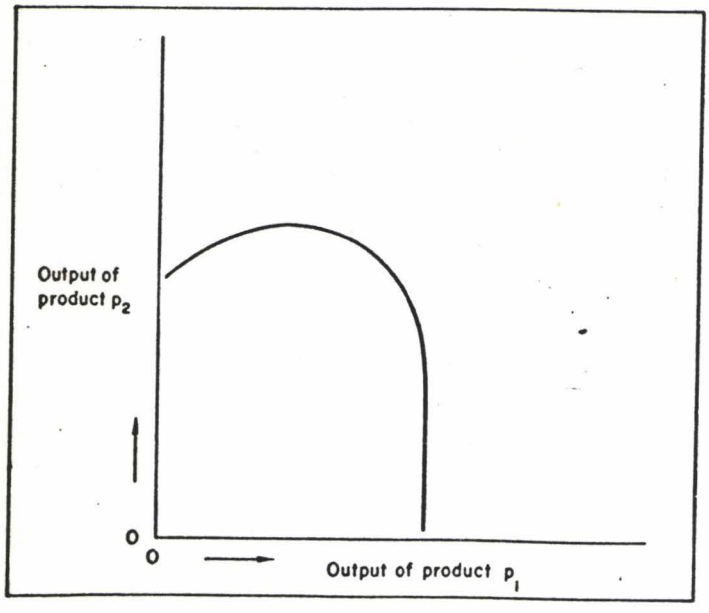

Figure 8: Product-product relationship with areas of supplementarity, competition, and complementarity.

Reproduced from R. Duane Lloyd, "Economics of Multiple-Use", Proceedings, Conference on Multiple Use of Southern Forests, Pine Mountain, Georgia, Nov. 1969

of products can be narrowed. (See Figure 9). The efficient decision must necessarily correspond to a point on an iso-cost curve, since these curves represent all the possible product combinations. For any given level of budget, the highest possible total value will be achieved at the output combination corresponding to the point of tangency between the iso-cost and ratio of marginal value curves. The curves representing the ratio of the marginal values remain parallel. Being analogous to iso-revenue curves of traditional economic theory, each ratio line represents a different level of total value (total revenue received). The linearity and parallelism results from the fact that few management areas would produce quantities of output large enough to significantly effect the marginal value (price) of the products. Hence, the ratio of marginal values (slope of the iso-revenue line) would not change with the level of total value derived. With some products or locations, this might not be true. In this latter case, the iso-revenue lines would be curved, and their location would necessitate a knowledge of product demand functions. Hence a line connecting these points of tangency (the "expansion path") will delineate all of those combinations that represent technically efficient combinations at each level of management.

The final step consists of identifying which combination on the expansion path will maximize the net value of goods and services from the area. The solution is illustrated in Figure 10. The lower part of the diagram consists of the expansion path as previously defined. The upper half reproduces the traditional economic relationship between total cost and total value. As stated by Gregory:[52]

> The only difference between this upper set of curves and those developed in usual profit maximization theory lies in their applicability to a production combination rather than to a single product.

A relabeling of "revenues" as "values" is consistent with the broader context of economic value as discussed previously.

The total cost and total value functions are derived from, and therefore directly related to the expansion path in the lower portion since they are functions of both outputs. The cost of producing (for example) the product combination x in Figure 10 can be read directly from the total cost function, and is identified by x. Therefore, if the objective is to maximize total net value from management of the area, the proper combination of timber and forage will be one which achieves the greatest possible difference between total cost and total value. This difference will be maximized where the slopes of the total cost and total revenue functions are equal.(53) For this example, this point is depicted in Figure 10 as being approximately 850 bd. ft. of timber and 1500 lbs. of forage.

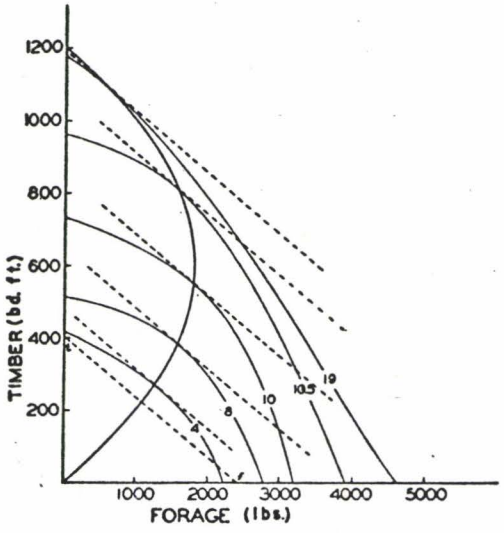

Figure 9: Iso-cost curves (_____) identify all product combinations that can be produced at equal cost. Iso-revenue curves identify all product combinations that will yield equal revenues. The expansion path, through points of tangency, locate a series of product combinations that should be considered by the land manager.

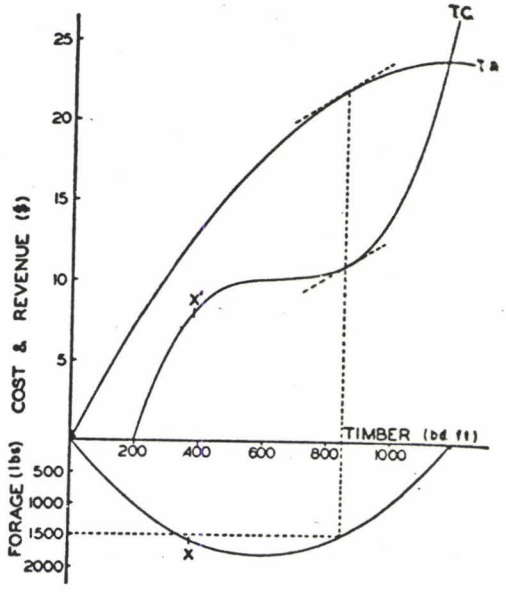

Figure 10: Solution of the two-product case. Total cost (TC) and total revenue (TR) curves in upper part of figure are directly related to the product combinations identified by the expansion path in the figure's lower portion.

(Fig. 9 and 10 reproduced from G. Robinson Gregory, "An Economic Approach to Multiple Use", Forest Science, Vol.(1), March 1955)

Problems

The problems of applying production economics to the multiple-use management of the Forest Service are formidable. It should be noted that the theory of production economics is based on the assumptions that (1) the biological and technical relationships of the production process(es) are known, and (2) the price system is reasonably operative, through the market, in establishing relative values for the uses and products produced or alternatively that other proxy measures of marginal value are obtainable.

First, consideration will be given to the problems associated with the biological and technical relationships of the various production processes of the Forest Service. As stated before, in order to make intelligent resource allocation decisions, it is necessary to have a sound knowledge of what goods and services, or more specifically, what various mixes of goods and services, can be produced using available resources.(54) Perhaps the most obvious and limiting problem dealing with this issue in applying production economic theory to multiple-use management is the lack of available data on these various physical relationships, both in terms of the single output relationships (production functions) and of the multiple or joint output combination relationships (product-product functions).

One underlying cause of this lack of data is the problem associated with units of measure for the outputs of some of the forests multiple uses. For example, measurement of water as a product, to be meaningful, must take into account three essential dimensions: quantity, quality, and time. Therefore, although quantity can easily be measured in any of several units (cubic feet, cubic meters, acre feet, etc.), two secondary but important problems must be resolved - over what period of time is the water flow to be considered, and what quality standards will be employed. Furthermore,

water quality is itself a many dimensioned thing with the measures of quality employed reflecting the use of which the water is to be put. For example, turbidity and purity are two aspects of quality which can be influenced by management.(55)

The timing problem, so far as watershed management is concerned, stems largely from the fact that in most watersheds the quantity of water yielded varies greatly from month to month, usually in a somewhat predictable fashion. Hence, some management practices may be designed to reduce peak flows (flood control) while others are instituted to increase flows at low level periods. Although the two are somewhat complementary, certain flows per unit time must be specified before management strategies can be designed.

Assuming the difficulties of output identification and measurement can be resolved, there are still many problems in the analysis of some of the multiple uses. In the case of watershed management, for example, if a specific management practice is instituted on the forest we need to know how much peak flows will be reduced or low flows be increased, and/or how much water temperature and turbidity will be affected. As noted by Gregory:(56)

> The science of watershed management is still very much in its infancy, yet unless one can state "If you do this to these acres it will usually increase (or decrease) the amount of water of the stated quality, at the specified time, by about this much," one cannot make any serious claims about managing a watershed.

Further, we need to know if the management practice represents a tradeoff of one use for another (for example, improvement in water at expense of timber) which implies a movement along a production possibility frontier, or an increase in resources available for management (larger budget or manpower) which alternatively indicates a shift along the production expansion path. Unfortunately, the analyst can gain little insight into

these relationships on the basis of most technical literature on technical product or use relationships published to date.(57)

Similarly, recreation outputs, like those of watershed management, are also multi-dimensional and somewhat undefined. Recreation output includes consideration of both the quantity and quality of output. Although the quantity of output can readily be measured in terms of the number of visitors as well as the number of visitor days, the quality aspects of recreation output are less easily measured.(58) This is especially evident when one considers measuring the unit of output (in terms of quality) of the aesthetic aspects usually associated with the production of outdoor recreation. Particular problems arise from attempts to define the qualitative aspects of outdoor recreation in terms of the resource base rather than the output. As a result of this, much research has been done in terms of the impact of, for example, overcrowding, on the resulting deterioration of resource base, while relatively little has been done regarding the effects of quality in terms of user satisfaction under various alternatives. In essence, the definition of quality and therefore much of the resulting research has been resource, rather than user, oriented.(59)

In terms of the technical aspects of recreation management, considerations such as the spacing of campsites, or the optimum density of hunters or of wilderness hikers, raise problems in defining a recreation production function since knowledge of their effects on recreation outputs are seldom precise. Further, each form of outdoor recreation may represent a unique "product" which competes in terms of resource use with other forms of recreation.

Wildlife management, from the standpoint of economic analysis, raises many of the same problems as mentioned for watershed and recreation.

> Scientific wildlife management has only recently reached a state where one could ask a group of wildlife experts for data needed in production function analysis and expect anything but incredulity. Yet is is difficult to imagine seriously claiming proficiency in management without knowing the general relationships between managerial inputs and the outputs of the product. (60)

Due in part to the "fugitive" nature of the resource, measuring wildlife populations can be very difficult. Newer techniques may help improve technical knowledge of wildlife production. For some time, however, wildlife population production changes and casual relationships between such changes and managerial inputs can only be roughly approximated.

In addition to the problems of the measurement of outputs of the various uses of forest lands and the problems of determining adequate single output production functions, outputs from alternative uses at the unit planning level are often (but by no means always) produced jointly. It is the necessity of this joint production of the various forest outputs because of increased demands over time (both in terms of the actual amount of output demanded and in terms of the increased diversity of demand for various outputs) that gives rise to most allocation decision problems facing public land managers today. That is, both increased absolute and relative scarcity of forest resources brought about by increased demands necessitate, in the majority of cases, that public forest managers consider joint production of possible forest outputs. This explicitly requires a choice of the "proper" output mix. That is, although it may be possible that a policy be adopted to allocate an entire management unit to the sole production of one particular output, it is probable that economic analysis will suggest that a mix of ouputs under either complementary or competitive use relationships is preferable. In both cases, however,

careful consideration must be given to the marginal tradeoff of uses that are evident on the management unit. A knowledge of the various product-product relationships that exist for that specific unit is required. This knowledge becomes especially important to decision-making when allocating land to uses that are competitive - that is, where allocation to one use necessarily foregoes the use of that land for another use.

Since there is a general lack of satisfactory knowledge regarding the production functions of individual forest uses it is not surprising that there also exists a lack of data regarding the various product-product mixes between forest land uses.(61) For example, after a recent study to attempt to determine the product-product relationships for forest land areas, Bell and Kirby stated:(62)

> After all these years of research, we do not have the information needed. As an example, we have fairly reliable information as to the effect of a specified thinning regime on the volume growth of timber over a period of time when we know the site class of the area on which the timber is growing. What we do not know is the effect of the thinning on the forage output for domestic or wild grazing animals, nor do we know the effects on water runoff, nor do we know the tons of fuel per acre resulting from one thinning operation, nor do we know whether leaving slash on the ground is more beneficial for protecting the site than it is detrimental from a fire hazard standpoint. We reviewed nearly one thousand research papers and ended up with less than twenty that were helpful in assessing effects on more than one output. (emphasis added)

Although problems of measurement, unreliable production function data, and unreliable data concerning the various product-product relationships severely limit current application of production economics to multiple-use decision making, it is important to note that these are definitional or empirical problems that should be largely capable of resolution through further research.

It should be noted, however, that generalization of research of specific areas regarding production functions and product-product relationships to establish guidelines for allocation decisions on other areas may be inappropriate. As Gregory points, out:[63]

> The shape of the individual curves, (referring to production functions and product-product relationships) as well as the pattern of the entire curve family, would be expected to differ for every area.

That is, they may be site dependent and would of necessity need to be evaluated within the context of each land-use situation.

Resource Valuation

One of the most difficult problems in applying micro-economic analysis to multiple-use decision making is that of resource valuation. Computation of an optimum product-product mix requires the use of marginal values for each of the outputs.[64] In some cases, values derived from the market place for each use or product are sufficient. In actuality, some products of forest management meet this requirement while others do not. In this latter case, surrogate measures of marginal value are required. In the absence of careful analysis, unstated implicit values predominate. The valuation of some of the other goods and services produced through the use of forest resources, however, is more difficult. This is particularly true of watershed values and of various kinds of recreation experiences, including exclusive recreational activities. Traditionally, forest-based recreation activities have been provided free to users. No fees are charged for the use of most federal lands for hiking, snowmobiling, and many other uses. Only nominal fees are charged for the use of federal campgrounds, and here again, many such facilities impose no charge. Fundamentally, there is no direct measure of marginal value as revealed by a market price.

Alpine skiing is one example of a forest-based recreational activity for which market-determined fees are charged by private and public operators, generally on a per day basis. The price of a lift ticket may be said to represent the marginal value of a day of skiing activity to purchasers. Unfortunately, there is no easy guide to the value of a day of hunting or fishing or backpacking or any of a number of other forest-based recreational activities which the average American may think of as "free". These values are referred to as intangible or non-market values, since no free market exists for their determination.

Economists have done considerable work in recent years to develop marginal value indicators for these nonmarket goods and services. Most of this work has focused on estimating the economic demand functions for outdoor recreation based upon estimates of consumer's willingness to pay. However, these quantative estimates of recreational demands, or similar methods of deriving estimates for the value of recreation, have been generally criticized on various grounds. Therefore, before discussing the various estimation techniques employed, consideration must first be given to these general criticisms.

The first problem relates to what can be considered a misconception in arguing that because of the aesthetic content, or because of some other characteristic of these goods and services, it is impossible to attach values to them. Some for example, have a great affinity for claiming that outdoor recreation fills some profound, deeply felt need of people; that itis very personal and unique and that it has highly variable values for individuals; that outdoor recreation defies any kind of measurement; or that it is priceless.(65)

However, there are a number of things which are overlooked or misunderstood in these arguments. One is that the use of outdoor recreation facilities differs only in kind, not in principle, from consumption patterns of ordinary goods and services.(66) Another is that the market process takes account of personal and varied consumer satisfactions for all types of goods and services producted in our economy.

> It is in fact one of the great features of the market mechanism that it takes account of the great satisfactions which different commodities afford different individuals and arrives at a single value for all of these goods and services.(67)

It is, furthermore, the marginal values which are important to the making of decisions. The marginal value of recreational developments of various kinds is a more relevant concept which is used in economic analysis for comparisons in spite of the very great aggregate value which some may want to attribute to these actitivies. The concern is only with the added cost and the added values of improving the allocation of various kinds of resources. Resource managers are seldom dealing with situations in which society faces the choice between having and not having any recreational opportunities.

> Nothing is gained, and perhaps a great deal has been lost, by what amounts to ascribing the importance of a total supply of recreation to an added increment, and not by concentrating on the marginal conditions.(68)

A similar difficulty arises with respect to questions of water supply.

> That man is entirely dependent upon the existence of water is repreatedly emphasized. While true, this dependence is not really important for decisions which necessarily focus on increments and therefore on the added costs and benefits that stem from adding small amounts to the existing total.(69)

No goods or services are priceless in the sense of an infinite price. There is a limit to how much people will give up to enjoy the services of any outdoor recreation facility development, or to preserve any scenic

resource.[70] These economic values are measured basically by what people are willing to give up in order to obtain them. The relevant economic measures of these values then is the marginal willingness to pay on the part of the consumers for these services.[71] This set of values is the same as the economic values which are established for market commodities, for it is "the willingness to give up on the part of consumers which establishes values throughout the economy."[72]

A second argument against estimated demand functions for measuring economic benefits from outdoor recreation is centered on the idea that the individual consumer's willingness to pay does not reflect the true social value of these services. It has been argued that external economies exist in the consumption of outdoor, and since these are not reflected in estimates of outdoor recreational values, estimation techniques understate the value of these services.

The existence of these externalities is an empirical question. To the extent that they exist, current demand-oriented methods for estimating the value of outdoor recreational services do underestimate the value of these services. However, the mere existence of external effects does not necessarily imply that the use of these estimated demand functions should be abandoned. Instead, existence of external effects means that efforts should be made to quantify such effects and incorporate them into the value estimates.

A related criticism might be brought forth against these estimates by making use of the terminology employed by Davidson, Adams, and Seneca.[73] They speak of "option demand" and "opportunity demand".

> Option demand reflects a present value of the resource to those who wish to maintain the option to consume in the future, even though they are presently not participating in the enjoyment of the resource. Opportunity demand reflects the future value

> possibly to arise from the use by those who may learn to enjoy a facility or service which they are presently not using.(74)

To the extent that current methods for evaluating outdoor recreational services take into account only the willingness to pay by those who are actively participating in the use of these services, again such methods may underestimate the true social value of these services. Obviously, however, this shortcoming is not unique to demand analysis for extra-market goods or those outputs related to forest land management. Further, a careful distinction needs to be made between "option value" of a commodity in general as opposed to the marginal output for the management decision at hand.

The third argument against quantifying the economic benefits from outdoor recreation stems from confusion between deriving the quantitive value estimates and possible policy conclusions which might be drawn from them. As external diseconomies in the consumption of certain recreational services (for example, through crowding and deterioration of the natural landscape) increase as rates of use of these services increase, the need for rationing the use of some of these services appears to be essential.(75) Given the widespread use in our economy of pricing as a rationing device, it is certainly not surprising that some increased use of this device has been suggested also for rationing of outdoor recreational services.(76) The point here is not to argue whether or not recreational services ought to be rationed by price, but is instead an attempt to redraw the distinction between economic analysis and economic policy. Rationing means economic choice irregardless of the policy instrument chosen to implement allocation decisions.

It appears that the basic issue here results from what has been called the "evaluation-reimbursement dichotomy".(77) This refers to "the practice

of divorcing economic evaluation from considerations of reimbursement policy".[78] This practice generally pervades natural resource management. The arguments in support of it are categorized in the following paragraphs.

Under certain circumstances, it may be argued that it is inappropriate to insist upon reimbursement of a project cost by those who benefit from the project. This argument is perhaps relevant when the primary purpose of the project is to redistribute incomes toward the beneficiaries of the project. While numerous resource development projects generally have income redistributive effects, their effectiveness must be questioned when they are used as tools primarily for this purpose. That is, one must then question whether this means is the most effective method relative to alternative income reallocation schemes.

Probably the most valid argument against reimbursement policies is that it may be very difficult to implement under certain conditions. These conditions may result from the existence of what Bator calls technical and public goods externalities.[79] In this case, marginal cost pricing would not permit recovering of the full costs of a project.[80] Public goods externalities arise then the amount consumed by one individual has no effect upon the quantity available for consumption by others. Therefore, "Charges made for such a good not only misallocate consumption, but also have no implication for production efficiency".[81]

When the supply of resources is characteristically that of abundance (lack of economic scarcity) the notion of forest resource outputs as public goods did not result in serious problems. Under present day conditions facing many decision makers, increased demands for most outputs has lead to a situation of economic scarcity and therefore, interdependencies among uses and users for major forest goods and services. Therefore, the treatment

of such outputs as public goods may be detrimental under today's conditions.

This point was also brought out in the Willamette National Forest Land Use Study, specifically with respect to wilderness areas.(82) The study states:

> The recent adoption of wilderness use permits provides some evidence that zero marginal costs do not prevail on some undeveloped areas at certain times of the year. Permits are a means of rationing scarce space, the very function prices perform in the market economy. Moreover, the allocation of permits is also evidence that wilderness services are exclusive and transferable. In other words, the Forest Service, or administering agency, must transfer the right to wilderness use to private citizens. This would lead us to the conclusion that wilderness-type recreation is not a public good.

The final argument against reimbursement grows out of a proposition in welfare economics which states that "an action leads to an improvement in efficiency if those gaining from it would be sufficiently better off to be able to compensate those made worse off by the action".(83) Whether or not compensation actually takes place is considered to be a question of income redistribtuion and "not relevant for efficiency analysis".

The fact which should be taken into account, however, is that failure to compensate has important efficiency implications in itself. The good or service, when made available below cost, will be demanded not only by those who are unable to pay the compensation, but also by all of those who value it more highly than the price at which it is actually obtainable by them. This means an increase in the use of the good or service, an increase in the use of other inputs used in its production, and corresponding decreases in the production of alternative goods from which the inputs have been withdrawn. The implications of this with respect to the efficiency aspects of multiple use management are quite clear.(84)

Evaluation Techniques

There are potentially some benefits or costs associated with a project that are not or cannot be valued directly in monetary terms. Economic efficiency criterion, maximization of net economic value, are not automatically satisfied in such cases since nonmeasurement costs or benefits are not captured by market transactions.(85) Alternative criteria to approximate acceptably accurate marginal values must be employed. Three general approaches to this problem have been offered in the literature.

McKean advocated that decision makers be provided with a schedule showing the net money valued benefits as well as a separate description of other benefits for each alternative that is considered.(86) The decision maker is thus to choose that alternative "which conforms best to his subjective evaluations or his interpretation of society's preferences or valuation of money valued benefits vs. other benefits".

In evaluating this approach to the decision problem with noncommensurate benefits, one must question the ability of the decision maker to determine society's valuation for unvalued benefits and to apply it consistently to a number of similar choices over time. In McKean's system, the decision maker is not encouraged to objectively determine an appropriate explicit relative value to be applied but rather is to rely on his own judgement after viewing the range of alternatives. Since each choice implies a trade-off between valued and unvalued benefits, the question is whether or not this trade-off determination will be relatively stable over time and over a number of choices as well as whether it will adequately reflect society's preferences.

Marglin has proposed a somewhat different technique.((87) Briefly, he suggests that some minimum level of one benefit be established and that the project be designed to maximize the other benefit subject to

meeting the constraint.(88) However there is no established rule for deciding which variables are to be constrained and which are to be maximized in this analysis. Furthermore there is no rule to determine the minimum level constraint values. The choice as to which variables to hold as constraints might well be made on the basis of analytical conveninece or some other equally arbitrary technique.

Otto Eckstein has argued that "economists could make an important contribution to policy making if they would...interpret the desires of policy people...and express them in an analytical form as an objective function, and get on with...the establishment of decision-models which will reveal explicitly what actions will maximize the achievement of specific objectives".(89)

Eckstein is referring to those cases where net money valued benefits do not measure all of the favorable effects on an expenditure program. His philosophy is that:

> If the preferences of the policy people can be expressed in terms of explicit weights or values of one form of benefit in terms of the other, then the consequences of this particular set of weights for the design and selection of projects can be clearly seen. More importantly, if these consequences are thought to be desirable, then the same set of weights or objective function can be used to achieve a consistent set of decisions concerning all proposed projects.(90)

It should be noted, however, that this rigidity of weights is not necessarily desirable. If demands change or if the supply of a good or service changes, the relative value of the goods and services also change. This is the result of the fundamental relationship between economic supply and demand. If these weights, or imputed values, were rigid, that is, not related to changes in supply or demand, allocation of resources would yield non-optimal results.

It is evident that these approaches to choosing among alternative projects when benefits are not commensurate fall short of the desired

explicit recognition of economic value and the trade-offs between values that provide the foundation of production economics. In spite of reliance on "decision-rules", valuation of some sort cannot be avoided. In the first two approaches, the valuation is implicit and obscure since reliance is placed on the value judgements of the decision-maker. These techniques do not make known to the members of society what relative values are actually implied by the set of choices made.

If weights are assigned and an explicit objective function is formulated, the valuations are obvious, and the implications of different weights for project design and selection can be determined. With values made explicit and subject to political review, decisions are more likely to reflect the general preferences of society, and less likely to be influenced by the pressures from special interest groups. It should be noted, however, that problems of voting and political process familiar to both political scientists and economists should not be ignored. It may indeed be a heroic assumption that political decisions and choices which are made reflect and are responsive to marginal social preferences.

As was pointed out by Freeman, these approaches are essentially based upon political decisions determining values for the non-marketed resources.(91) Another school of thought, however, is based upon the philosophy that values should determine the decisions for these resources. Primarily, these latter methods attempt to impute a proxy monetary value for non-market goods. These methods vary in their approach to imputing this monetary value, and include techniques based on (1) evaluation based on willingness to pay, (2) methods based on alternatives, (3) methods based on expenses incurred, (4) cost method, and (5) a market value method. A brief discussion of these methods follows.(92)

Willingness to Pay

Several estimation procedures have been proposed based upon the methodology of willingness to pay. The essential objective of this methodology "requires the assignment of prices which would have resulted from market behavior if there had been...a perfectly competitive market for them".(93) Thus willingness to pay measures what people are willing to sacrifice or give up to obtain the good or service and therefore measures its relative marginal value.(94)

Because of a number of unresolved empirical and conceptual problems, however, significant "knowledge gaps" on the demand aspects of non-marketed goods are evident.(95)

Because no market actually exists, some of these evaluation techniques have empirically attempted to use surrogate measures for the actual variables incorporated in a demand function. In the case of outdoor recreation, for example, the Hotelling-Trice-Wood Method(96) and the Clawson Demand Curve Method(97) assume that "the willingness of recreationists to incure costs of travelling to a recreational facility, and thus, distance, is an adequate proxy for the price of a tangible marketable good and that diminishing marginal utility is accurately reflected in demand curves of this type."(98)

As is the case with any surrogate measure, when it is employed there will necessarily be a level of divergence between values of the variable one desires to measure and the actual surrogate measure. In the above example, much literature has been devoted to the use of and nature of time travel costs as a measure of the demand for outdoor recreation.(99)

Conceptually, many of the problems associated with willingness to pay value estimates deal with the issue of consumer's surplus.

Briefly, consumer's surplus is considered to be equal to Total Benefits (value) - Total Revenues. As Coomber and Biswas state:

> Resting on the assumption (discussed above) that diminishing marginal utility of recreational experiences is adequately reflected, a normal marshallian demand curve may be established. (Figure 11). Total revenues are assessed for any price-quantity relationship, normally that of maximization, by measurement of the rectangle beneath the curve. Where Q, represents goods that are sold, total benefits may be assumed to be equal to the area under the curve to the left of Q1. Consumer's surplus is represented by the triangular area (where demand curve is linear) above total revenues.(100)

The conceptual problem is whether or not consumer's surplus is relevant in the estimates of value for recreational facilities.

Proponents of the inclusion of consumer's surplus essentially argue that

> The value of the resource to recreationists, in terms of the consumer's surplus they enjoy under free access, consists of the sum of the maximum tolls that they would be prepared to pay in addition to their existing fixed costs.(101)

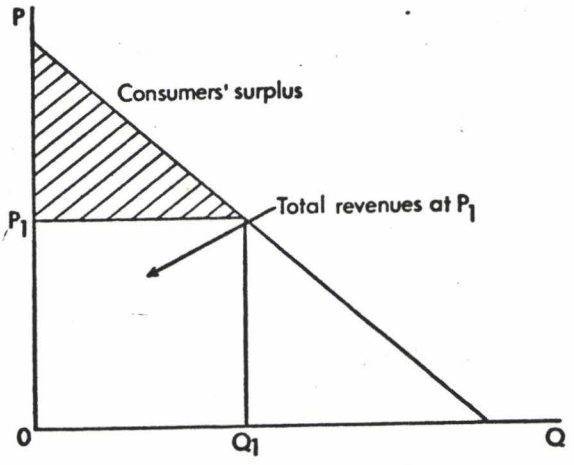

Figure 11: Demand Curve Showing Consumers' Surplus

Reproduced from Nicholas H. Coomber and Asit K. Biswas, Evaluation of Environmental Intangibles, General Press, Bronxville, N.Y. (1973)

In opposition, the argument is essentially that

> this...would not yield a net benefit figure comparable to that derived from other uses of the resources which would normally be subject to a single price or single prices for each different class of user.(102)

That is, in order to capture the consumer's surplus in a market situation, the supplier would have to be able to price discriminate perfectly which is not witnessed in actual market transactions. Similarly

Similarly, Coomber and Biswas conclude that

> the use of consumer's surplus in the assessment of recreational benefits...is inapplicable unless equivalent estimates of consumer's surpluses are made for all other goods with which recreation is to be comparatively evaluated.(103)

This same position is taken by Kelso, as he states,

> If discriminatory pricing is attached to the publically produced project output, it must also be attached to the privately produced alternative. If consumer's surplus is a benefit on the 'with the federal project' side of the comparison, it is equally a benefit on the 'with the private alternative' side.(104)

Kelso further states that, "

> the presence of noncompetitive elements in market prices and the use of discriminatory pricing in valuing prime benefits of government output - market prices are not the only proper measure of project outputs and inputs. However, market prices will continue to be the most feasible and most generally used measure of benefits and costs...but much theoretical and empirical work needs to be done by economic analysts on the improvement of value measures of government resource development outputs and inputs.(105)

For most public output decisions the major allocation question involves marginal adjustments in output mix. In contrast, the use of consumer surplus attributes an all-or-nothing demand to each decision. For example, the use of consumer surplus for evaluating the demand for a free-flowing stream, as discussed by Knetsch,(106) attributes the total area under the demand curve as the gross benefits generated. If, on the other hand, the management of that stream contributes only an increment to total recreation supply of that type, there is little reason to believe that an all-or-

nothing situation is involved. Finally, the concept of consumer surplus is obviously related to estimates of total value, not the marginal value as necessarily related to output decisions. One must ask how estimates of total value (area under demand function) will assist the resource manager. Even if conceptually measured correctly, there is little usefulness of such measures and they can detract from the search for relevant proxy values of alternative resource outputs.(107)

Methods Based on Alternatives

Methods based on the alternatives approach utilize the economic concept of opportunity cost. The underlying concept of opportunity cost relates to the value of alternative resource uses foregone by the choice of a given allocation.

Resources employed in any given use generate a certain amount of product. The real cost of this product is what these resources could have produced in another alternative employment. The real economic cost is the maximum value the resources could produce in any other feasible use. Opportunity costs expressed in money terms depend upon the marginal values of alternative commodities as well as upon the physical productivity of the resources in alternative uses.

The opportunity costs associated with investing public resources in a given end use may take basically two forms. First are those implicit costs which deal with foregone alternative uses when resources such as land and labor are allocated to some specific use. Second, and perhaps more obvious are explicit or budgetary opportunity costs. Monies budgeted to one use cannot be budgeted to alternative uses. This approach to opportunity cost may seem completely obvious, but is mentioned to re-emphasize the often overlooked implicit opportunity costs. Both types

of cost are extremely important for optimal decisions in natural resource allocation. Unfortunately, implicit opportunity costs have often been ignored. To be helpful in small area land use decisions, such costs must also focus on marginal increments, since most production or allocation decisions involve output choices in the range of increasing cost. In these cases, the use of "average" costs, even if adjusted to include implicit costs, will understate the true marginal costs. The adequacy of this technique for accessing intangible benefits, however, is dependent upon the degree of correspondence between marginal cost and the consequent marginal benefit generated.

As was the case in the expenditure method previously discussed, this methodology assumes that the benefits derived from a project must necessarily equal (or be a multiple of) the costs incurred. Clearly this may be an unwarrented assumption.

The value of this technique, however, lies not in its ability to impute a monetary value of intangible benefits, per se, but instead through emphasizing the opportunity costs involved in resource allocation decisions. If, for example, the costs involved in terms of the value of foregone alternatives are known, then the decision-maker will know the minimum value that the benefits must command in order to economically justify such an allocation. In the absence of adequate estimates of values, this is extremely useful information since it constitutes a "bench mark" from which allocation considerations may begin.

Expenditure Method

The gross expenditure type of method (commonly applied to outdoor recreation) attempts to measure the value of resources to the user in terms of the total amount spent on securing use by the individual. Estimate of

gross recreation expenditures are very popular among advocates of recreational projects since such estimates are likely to yield large figures, which give the impression of a large and profitable tourist-recreation business.(108)

The underlying assumption of this methodology is that the value of a day's recreation is worth at least the amount of money spent by a person for that purpose. These values have some use in indicating the amount of money spent on a particular type of activity, although it must be recognized that they represent expenditures for many goods and services, some in the year under study but some in previous years. The figures also have some utility in establishing the income effects of local residents in the area, and therefore in determining the effects of local investments for this purpose. (see following section on Impact Analysis) But they are of little or no consequence for justifying public expenditure on recreation, or for determining the worth or benefit of recreational opportunities afforded.

As Coomer and Biswas point out, this methodology does not reflect net benefits, and "it reflects secondary benefits in addition to primary by including expenses incurred at nearby retail outlets who benefit the local community by adding to regional income".(109) Clawson, however, argues that this is not a particularly useful property since net income is not indicated.(110)

As stated by Clawson and Knetsch,

> what is needed is not some gross value but the value added by a particular recreation opportunity. It is this net increase in the value of the recreation opportunities produced that is critical; this represents a true net yield that can be compared with what the resources would yield if they were used to produce other services. It is this margin above the cost of taking advantage of the recreation opportunity which measures the real monetary value that would be lost if the recreation opportunity

> were not available. The gross expenditure figures in themselves do not measure this. They tell us the magnitude of the industry, in one snese, but they do not indicate the value of the losses that would be sustained if the particular recreation opportunity were to disappear, or the value of the net gain from an increase in a particular recreation opportunity.(111)

It is interesting to note that in 1960, the Select Committee on National Water Resources proposed this method which estimated fishing and hunting benefits as represented by an amount equal to the expenditures by participants.(112) However, in the same year, the U.S. Interagency Committee on Water Resources of the Fish and Wildlife Service stated that "...no satisfactory basis was found for arriving at a usual relationship of sportswear expenditures to the net value of the recreational activity".(113)

Cost Method

The cost method assumes that the value of outdoor recreation resource use is equal to the cost of generating it, or, in some extreme applications, to a multiple of that cost. Any recreation project which is contemplated can therefore be automatically justified on grounds of "intangible considerations".(114) However, as Crutchfield states,

> This method offers no guide to evaluating a contemplated loss of recreation opportunities, and it allows very little discrimination between the relative values of alternative investment opportunities.(115)

The U.S. National Park Service in 1950 adopted two methods for assessing benefits at reservoirs, one of which was the cost method. They argued that

> a reasonable estimate of the benefits arising from a reservoir itself may be normally considered as an amount equal to the specific costs of developing, operating, and maintaining the recommended facilities.(116)

Most other authors concerned with recreational benefits have dismissed this method since it automatically justifies any project and there can be no valid basis for the assumption that benefits equal costs.(117)

Market Value Method

Methods based on the market value method utilize a schedule of charges to represent the market value of the services produced. For example, in the case of applying this to recreation, attendance figures are multiplied by the appropriate charge to arrive at a recreation value for the recreational services produced by a facility. These value figures, which are usually related to prices charged at privately owned recreational areas, are intended to measure the amount that users would be willing to pay if payment were required.(118)

The schedule of values historically used and the rationale for their selection is contained in a supplement to the general policy guide for water resources development, which stated:(119)

> In evaluating outdoor recreation as a project purpose, it is necessary that it be viewed as producing an economic product in the sense that a recreation opportunity has value and is something for which people are willing to pay.

However, one may question the appropriateness of using charges at private areas to measure the value of recreation at public areas, as the markets for all outdoor recreation are not fully competitive, and demand at private recreation areas is affected by the existence of public areas. As Clawson and Knetsch point out(120)

> The charges that users are willing to pay at private areas may largely reflect payments for benefits in excess of those available at public areas - better natural resources, better improvements, better management, less crowding, for example. It is precisely because private areas are not fully comparable with public areas that users are willing to pay fees or charges.

Furthermore, merely multiplying the attendence figures of an area by a single unit price, even if the price is assumed to be an adequate reflection of the current marginal value, would not yield helpful estimates of total value. Allocation decisions involve commitment of resources at the margin involving additional costs in order to generate additional increments to total value.

Impact Analysis

The discussion of production economics has implied that small land use allocation prcisions can be evaluated in terms of their economic efficiency - that is, the overall consequences of resource allocation with respect to the mix of outputs and the level of output(s) undertaken. The objective of such analysis is to help guide decisions so that the optimal mix of outputs is undertaken and so that the investment of scarce social resources is consistent with the total array of economic demands at the margin. It is still necessary, however, to consider the distributional aspects or consequences of that allocation. This distributional question has two primary elements that are discussed in this section. First, there are the traditional questions of equity - the distributional impact of the direct costs and benefits of the productive activity. Secondly, there are important distributional questions related to the induced and secondary consequences flowing from the productive activity. A clear distinction of these distributional impacts is necessary to the overall evaluation of land use decisions. Further, the distributional aspects of land use decisions must be distinguished from those considerations already noted with respect to production efficiency. A failure to clearly make this distinction will undoubtedly lead to distorted measures of allocative efficiency and result in allocation decisions based on pressures for shifts or redistributions in program costs or benefits rather than overall allocative efficiency.(121)

Externalities

A primary consideration in impact analysis, and one of the prime sources of confusion in economic analysis of allocation decisions, is the emerging significance of economic externalities - the generation of costs or benefits that accrue to individuals not directly involved in the resource

allocation decision. The "individual" involved may be a single person or, at the other extreme, the aggregation of unspecified individuals collectively constituting "society". In this latter case, the benefits may be borne equally and collectively or distributed broadly but on a differential and competitive basis.

The most useful distinction to be made in the analysis of externalities is whether the consequences of the externality are manifested through the market (reflected through price changes and consequent adjustment in allocation decisions) or are expressed outside the market (reflected in noncompensated changes in the technical ability to utilize resources). This distinction has been made clearly by Scitovsky wherein he discusses the relationship between externalities and equilibrium theory.[122] By specifically contrasting direct (or nonmarket) forms of economic interdependence with pecuniary external economies (interdependence through the market mechanism), he focuses on the distinction between allocative efficiency and income distribution.

As discussed in the preceding sections of this report, a major focal point in the allocation of resources at the Unit Planning Level is economic efficiency - that is, selection of the output mix most appropriate with respect to the multitude of economic demands expressed by society. Production economics has been explored as a framework for evaluating these allocation decisions. The literature in the field of general equilibrium theory includes extensive discussion of necessary modifications required in market analytics to account for non-measured costs and or benefits. These modifications relate to both inclusion of appropriate values for non-priced outputs (or inputs) as well as the consequences of technical externalities wherein the cost is borne by

third parties.[123] It is this latter case that often becomes obscured in the analysis of small area planning decisions.

Where technical externalities exist (along with non-market outputs and/or public goods), an adjustment in the measure of marginal value or marginal cost is required. Market-generated values in such cases will not indicate appropriate guides for allocation decisions. The resource manager will attempt to estimate total value generated at the margin irregardless or whether or not that value is registered in the market-place. He will, likewise, attempt to estimate total costs at the margin irrespective of whether they appear internally (as an explicit management cost or as an implicit opportunity cost) or are externally borne by third parties. This modification is simply an extension of the traditional production economics framework in order to fully reflect the allocation consequences of specific management decisions.

The case of pecuniary externalities is simply a reflection of economic interdependence throughout our economy. Price signals guide the vast multitude of economic decisions and indicate changes in relative scarcity in both factor and product markets. Factor payments, economic rents, and income distribution all change in response to the changing mosaic of demands expressed by consumers. These changes in income distribution are undoubtedly of great public interest. It is also important to recognize that they indicate distributive or equity impacts of management decisions and are seldom significant with respect to allocative efficiency. As stated by Scitovsky:[124]

> Interdependence through the market mechanism is all-pervading, and this explains the contrast between the exceptional and often awkward examples of external economies cited in discussions of equilibrium theory (technological external economies of direct interdependence) and the impression one gains from the literature...

> that the entrepreneur creates external economies and diseconomies with his every move.
>
> What is puzzling, however, is that interdependence through the market mechanism should be held to account for the failure of the market economy to lead to socially desirable optimum, when equilibrium theory comes to the opposite conclusion and relies on market interdependence to bring about an optimum situation. Pecuniary external economies clearly have no place in equilibrium theory. The question is whether the concept is meaningful elsewhere.

The problems of accounting for unmeasured benefits and costs along with circumstances of technical externalities, and the inability of the marketplace to automatically handle these situations, have lead in large part for the intervention of the government sector into natural resource production situations.(125) In so doing, the government becomes a participant in economic affairs, securing (or withholding) productive factors for its own use and distributing a variety of outputs via the marketplace or other allocative means. In so doing, it cannot avoid influencing to some degree the distributional impact on the local, regional or national economy. Efficient public production will always have a pecuniary effect through the marketplace due to interdependencies on both the supply and demand side.

The consequences of pecuniary economic interdependency is largely taken for granted in the private sector. Where adverse distribtuional consequences result, direct compensating public programs may be initiated. However, when the public sector is directly involved as an economic participant, the distributional aspects take on more significant political importance. In many cases, these distributional consequences may be the primary objective (for example in manpower retraining programs, or regional assistance programs such as the Appalachian Regional Commission).

Because of the distributional consequences of federal activities,

the assessment of economic impacts has become a significant aspect of program evaluation. What must be kept in mind is the distinction between the analysis of production efficiency and the consequent distributional impact of that production. Although both types of analysis are important, they do not measure the same thing.(126)

As referred to above, the role of pecuniary externalities or market-induced economic change is not directly related to economic efficiency. Where the primary purpose of analysis is to determine feasibility of alternative resource allocations, such measures of impact are not relevant. If corrections have been adequately made in the measures of marginal value and marginal cost on the basis of technological externalities and non-market outputs, the pecuniary impacts simply reveal the redistributions resulting from the new allocation of resources.(127)

> ...the important point to note is that pecuniary externalities, be they economies or diseconomies, pose no problem for the market economy. Indeed, they are the central ingredient of the market place. Changing demands cause prices to rise and fall; these fluctuations provide the essential signals for the market place to ration the available goods and services efficiently....

In the analysis of land use allocation or management decisions it is increasingly common to evaluate the scope and level of secondary and/or induced economic impact. It should be clear that this effort is directed towards tracing out the consequences of pecuniary externalities. The estimation of these impacts are of necessity arbitrarily limited in scope, both with respect to geographical context and the level or extent of disaggregation. The estimated impact will be different depending on the geographic scope and/or sectors evaluated by the analyst. In this sense, there is no single "economic impact" of a decision or project; rather there are as many impacts as there are relevant parameters to be placed on the analysis.

The initial interest in secondary impacts has been discussed in a series of papers prepared by the Natural Resources Economics Division of the Economic Research Service, U.S. Department of Agriculture.[128] Although some interest in secondary impacts can possibly be traced to the Reclamation Act of 1902, most contemporary policy is normally attributed to the Flood Control Act of 1936. In reference to "Guidelines Provided by the Congress", Taylor stated:[129]

> The Flood Control Act of 1936 specified that flood control projects could be assisted 'if the benefits to whomsoever they may accrue are in excess of the costs, and if the lives and social security of the people are otherwise adversely affected.' The types of benefits and costs were not specified. The subsequent 'Green Books' specified limitation of analysis to national income gains primarily, but they had no official congressional sanction nor uniform agency concurrence.

In reference to this same Act, Long stated:[130]

> The emphasis on the necessity for economic quantification of costs and benefits of projects can be traced back to the Flood Control Act of 1936. Among other things, this act laid the foundation for the favorable B/C ratio, specifying that benefits must exceed costs...'to whomsoever they may accrue' to qualify for congressional authorization. Such a criterion requires no consideration of the distribution of benefits, the implicit assumption being that the aggregate benefits will have the same value regardless of the manner in which they are distributed.

Further in his discussion Long identified perhaps the major policy issue involved in the analysis of secondary impacts:[131]

> Much of the debate concerning secondary benefits centers around the issue of national-regional competitiveness. If the assumptions of a neoclassical competitive economy are met, there is little basis for expecting secondary benefits to contribute to net national income, since any gains in the region will be fully offset by losses somewhere else.
>
> .....
>
> In order to legitimately count secondary effects as contributions to net national income, it is essential to count as part of the alternative cost all the secondary benefits that would have arisen had alternative investments been made.

If the distributional aspects of management decisions are not conceptually related to the overall efficiency of resource use, except in

special situations of unemployment, factor immobility, or other competitive imperfections, the purpose of including such impacts in the analysis of land use planning obviously relates to a concern of who receives benefits (directly and indirectly) and who bears the costs:[132]

> Conceptually, there is no useful purpose to be served by a separation of changes in income to local residents, other than direct beneficiaries, into induced-by and stemming-from benefits. The kind of local secondary effect does not matter. What matters is who benefits, and by how much, and who pays the costs.

Impact Methodology

Economic impact analysis has as its objective the tracing out of successive impacts or effects of some initial economic stimulus. Traditionally, economic impact analysis has focused on output effects - that is, the cumulative changes in output resulting from (or attributable to) a specified change in output in some given sector or market. Further extensions of impact analysis have been attempted to account for not only the level of output but also such other economic parameters as income and employment. The fundamental basis, however, remains the structure of the interdependencies within a defined economy expressed with respect to both the producing sectors and their dependence ultimately on final markets.

The majority of studies dealing with impact analysis in the area of forestry or forest management can be classified as either descriptive or predictive.[133] In the first case, the analysis simply intends to portray a view of the economy and the significance of the forestry sector(s) to total area economic activity. Beyond this level, however, much effort has been extended to the use of impact analysis to predict the consequences of actual or hypothetical changes in the level, composition, or location of specific activity or land uses. In either the descriptive or predictive situation, the scope of analysis may be national, regional, statewide, or local.[134]

Impact analysis traditionally depends on the use of either economic base theory or input-output analysis. No attempt is made here to review the extensive literature in either of these methodologies; rather, a brief description of each approach is given below.

Economic base methodology[135] simply recognizes that certain types of economic activity depend on other activity within the region under analysis while other components of activity directly serve final markets either locally or outside of the local area. Base analysis methodology attributes to this latter activity the source of the first. Hence, the economy is divided into two sectors: basic and non-basic. Basic sectors are those that either serve local final demand or export their output beyond the local economy. Non-basic activities, on the other hand, depend upon the existance of basic activities for their occurance. It is assumed that a functional relationship exists between the basic and non-basic sectors of the economy. If some exogenous change occurs in the basic sector, there will be a corresponding proportional change in the non-basic sectors. For this reason, the total economic impact can be expressed as a proportion of the initial exogenous change. This is normally done with respect to output or sales level, but can also be extended to income and employment.[136] A prime limitation of this methodology is the generalization of the economy into two homogeneous sectors and the related assumption that the two sectors are functionally related in some relatively fixed proportion. Its prime advantage lies in its relatively easy data requirements and ease of exposition.

Input-Output analysis[137] is in many respects a refinement and further extension of economic base analysis. The economy is disaggregated into individual economic sectors (the number of sectors dependent on the

local economy, data availability and resources available to the analyst) with an interaction matrix showing the relationship of each sector with each other sector and with each source of final demand. The structural interrelationship is two dimensional - showing the source of all inputs as well as the destination or origin of demand for output. Through the mathematical manipulation of the intraindustry matrix, the direct and indirect consequences of a change in the fianl demand level of output for any sector can be approximated. Further, this direct and indirect consequence can be identified by resultant sector, helping to visualize the distributional aspects as well as the aggregate impact. Since the technical input requirements of each sector are held constant (linear production function) and the source of output sales is also assumed constant, the impacts can be expressed as "multipliers" or proportional changes resulting from unitary changes in any specified sector.(138)

The additional detail and specific nature of input-output analysis is not easily obtained. The use of input-output analysis requires a detailed study of the economy in question, a task not normally within the reach of most small area land use decision-making situations. For this reason, most applied studies have relied heavily on preexisting studies done by other research organizations at the national, state, or (occasionally) local level.

Extensions of Input-Output Analysis have been attempted as a means of overcoming many of the limitations of traditional analysis, particularly with regard to the non-market aspects of economic production.(139) The applied work in this area by both Isard(140) and Hite and Laurent(141) attempt to integrate traditional input-output analysis with an accounting of pecuniary impacts through the recognition of non-market costs and

benefits. This latter recognition has, or course, both efficiency and distribution implications. These methodological extensions attempt to establish non-market input requirements for various economic sectors (normally expressed in physical terms) as well as coefficients for non-market outputs produced as a joint product along with the desired sector outputs. For example, space requirements (congestion) could be used as an input while air or water pollution might be a non-measured output.

Through such extensions of input-output analysis, the efficiency effects of non-measured inputs and outputs are explicitly brought into view, if not on a comparable value basis. Further, the secondary or induced impact of these non-market inputs and outputs can be evaluated, again if only in physical terms. Nevertheless, these approaches offer the stimulus for further work towards integrating production economics impact analysis.

Problems in Impact Analysis abound. These may be selectively grouped under the following groupings: (1) regional designation, (2) sector definition, (3) data requirements, (4) multiplier analysis, and (5) static vs. dynamic view of economy. Each of these problem areas is discussed briefly below.

The designation of the region or area to be included in the analysis is critical from the standpoint of the subsequent results obtained. The nature of most economic activity is that it does not respect arbitrary boundaries. The interdependence between producers and consumers can be extended almost without limit geographically. Although the economic impact is much like the ripples from a pebble tossed into a calm pond, it is equally difficult to define where either the ripple or economic interaction ends. Further, like the ripple, the effect may rebound

and in turn exert a feedback effect upon the economy.

From an applied standpoint, most economic impact analysis is predetermined on the basis of political or geographic boundaries. This is simply a reflection of both political and data constraints. The analyst must work with what data is available and must structure the analysis for the purposes of the decision-maker. Since the main contribution of impact analysis is to display the distributional or equity impacts of resource decisions, it is perhaps not surprising that political and equity considerations predominate in the selection of the appropriate region to be studied.

The choice, however, is not without significance. The major methodology (input-output) depends on the interaction between economic units of the economy. Hence, there is a presumption of some degree of stability in this relationship. As the analysis is constrained to smaller and smaller geographic areas, this assumption becomes increasingly suspect. Further, the feedback effects (linkages between sectors) becomes progressively weaker the smaller area evaluated. For what is an interdependency at the state level becomes a leakage from the local community. For this reason, most estimated impacts become larger with an expansion in the scope of the analysis.

Sector definition presents the second major problem area in impact analysis. Each economic unit represents a separate sector at the extreme. Yet it is impossible to conduct any reasonable analysis at the individual level - hence some degree of aggregation is necessary. For most purposes, the basic economic structure as defined in the data accounts of the Federal government is used. This is based on the Standard Industrial Organization scheme used to compile practically all government statistics.[142] Yet,

the use of the SIC system still leaves unresolved the "proper" degree of aggregation to be employed in any particular analysis. In part, the answer lies in a pragmatic determination as to what sectors are important to those undertaking the analysis. Secondly, there may be restrictions imposed by the data sources. For example, many publications by the U.S. Department of Commerce, Census Bureau do not reveal data at any level that would disclose the identity of any reporting unit. Hence, for the analysis of small areas (county or below) it is exceedingly difficult to obtain reliable information except at the most highly aggregated level. Even at the state level, data availability can impose severe constraints on the desired degree of disaggregation.(143)

Because of the importance of feedback linkages in impact analysis, the aggregation problem cannot easily be overlooked. For what may appear to be a feedback at a highly aggregated level of analysis may actually represent an overstatement when the specific subsectors of the economy are examined.(144) Further, many outputs from the land use allocation decision may not be included in specific sector definitions, or where of a non-market nature, may not fall within the traditional sector definitions at all. The treatment of outdoor recreation is a case in point. There is no definition of recreation as an economic output in traditional economic accounts. Thus the analyst is faced with creating an "industry" in order to deal effectively with such situations.

Problems in <u>data requirements</u> have been mentioned on several instances in the preceding discussion. The use of economic base models, and more importantly the input-output models, requires extensive data regarding the structure of the economy as defined geographically for the purposes of the analysis. This necessitates not only a knowledge of the sector or sectors directly impacted by the land use planning decision, but also

knowledge of all other sectors and their interrelationships with each other. The analysis can seldom produce original data of this magnitude. When attempting a specific area analysis it is still common to rely on secondary sources for the bulk of the economic data.[145] Also as has been noted, data on non-market outputs and their relationship to other sectors is almost totally lacking.

A major problem, even where reasonably complete economic data exists, is the use of sector averages to define marginal changes in economic activity. The use of input-output methodology implicitly assumes a linear-homogeneous production function where marginal and average coefficients would be identical. However, this assumption may not be valid where significant changes in output levels are potentially involved, although it is less restricting where incremental adjustments are evaluated.

Multiplier analysis presents one of the greatest advantages of economic base analysis yet simultaneously presents one of the greatest problem areas to confront impact analysis. Simply put, there can be a multiplier calculated to represent almost any economic relationship. It can only be as valid and useful as the data and the assumptions upon which it rests. Two specific problems to be noted are (1) the distinction between "forward" and "backward" impacts and (2) the determination of the proper "base" for the multiplier.

The problem of forward impacts has seldom been recognized in the economic literature on impact analysis.[146] Traditional methodology assumes perfectly elastic supply functions whereby each economic sector can secure the necessary inputs to increase output in response to demand changes. However, when evaluating resource use decisions at a small area level, there may be several practical limitations to input supply.[147]

This may be particularly true in the production of basic raw materials for industrial production and/or the provision of area-specific outdoor recreation - both situations confronting resource managers in the Western United States. A restriction in timber output, for example, affects not only the suppliers of the timber-production sector. Yet it is this "backward" impact that is measured in traditional analysis.(148)

> But is this the end? There is reason to believe that it is not. The logs coming out of the woods went someplace - perhaps to the mill on the edge of town. The traditional model assumes that the mill gets logs elsewhere, but in fact there may be a real supply constraint for the mill when the timber harvest is reduced in the local area. Although it is often tempting to overdo this point, it needs to be built into the analysis. The change in timber supply, in this case, spills "forward" into the primary producing sector, and this forward impact leads to substantially larger impacts than would the backward effect considered alone.

The application of multiplier analysis presumes some quantity to be multiplied. Although obvious, it is often not a simple matter to translate a policy or land use allocation change into the appropriate direct impact. Multipliers, be they output, income, or employment (the most common types) to be useful, must be combined with the measure of direct impact to give the estimated total impact resulting from the proposed or actual change in resource use.(149) The resulting measure of total impact will be no more accurate than the measure of direct impact. This is a difficult step in the anlysis because of the deficiencies already noted in obtaining valid information regarding production functions and product-product relationships. In most cases, only limited quantative information is often available about the direct physical impacts on output levels, let alone about the direct economic significance involved. This is a particularly serious problem when dealing with the various non-market goods provided through forest land management.

The construction of income or employment multipliers also involves

another step and hence potential limitations in application. Such multipliers rest on the presumed relationship between output levels (in either physical or value terms) and the corresponding level of income or employment. While perhaps obvious, there is little evidence to support the use of "average" wage rates or labor productivity as relevant measures of marginal impacts. Such problems as wage agreements and under-employment of labor, as well as the particular input requirements of any given sector, may well result in marginal changes quite different from those projected through traditional multiplier analysis.

A final limitation to multiplier analysis involves the use of income-induced impacts whereby the direct and indirect income generated is assumed to be respent by recipients. Technically, the household sector is made dependent on locally-generated income and internalized into the intraindustry matrix. This results in the necessity of assumptions about the consumption function for marginal income. The most common approach is to assume that the marginal income will be spent in the same manner that initial income was spent, so that the coefficients developed from the household final demand vector can be used as household "input" coefficients. Studies of cross-sectional income expenditure patterns would indicate that this is a weak basis for predicting the use of marginal income by most households. While expenditures for all items within the current consumption package may be anticipated, there is no reason to believe that consumption will not also be extended to items currently foregone or that existing consumption will increase proportionately. For this reason, most Type II multipliers[150] likely overstate economic impacts by an undetermined amount.

The use of induced income effects also tend to ignore the time element involved. Seldom do economic impacts occur instantaneously.

Rather, they occur only over time - in some cases only over a period of years as the direct and indirect consequences work themselves through the economy. For this reason, the use of static impact analysis can be particularly limiting. While some impacts may increase with time others will likely decrease as other dynamic factors prevail. Further, it is analytically difficult to separate the various elements of dynamic economic change. The economy of any given region or locality seldom remains constant, with or without the impacts imposed through specific land use decisions. These decisions simply impose an incremental adjustment burden on the economy rather than create a separate and unique impact. In some cases, the impact may be the reduction of potential development of resources at some future point in time. For example, in the case of wilderness classification an area of commercial timber potential which is currently not operable for economic or other reasons may be involved. Present timber output is not reduced, jobs are not lost, and income payments do not terminate; rather, the potential for these economic contributions at a future date may have been foregone. This constitutes a future opportunity cost, not an immediate economic impact. In such cases, it is exceedingly difficult to compare potential impacts with potential future resource values; yet the problem cannot be ignored by assuming the economic environment is static.

To be truly useful in a dynamic context, impact analysis needs to focus much more carefully on the estimated stream of differential economic gains and losses for the area in question over some defined future time period. This needs to be interpreted and utilized within the context of the economic adjustment burden implied by the land use planning decision and not carelessly confused with measures of production efficiency.

Measures of direct and indirect impacts should not and cannot be substituted for more explicit consideration of benefits and costs in management decision-making. Production economics and impact analysis should be carefully distinguished. Each has a major function to fulfill in resource allocation where used appropriately. Each can confuse the true nature of economic decision-making if used incorrectly, leading to reductions in the aggregate social value of all resources devoted to the planning effort. If planning is deemed to have the objective of better use of scarce resources, that effort itself must be viewed as a competing use of resources.

PART III

SUMMARY FINDINGS AND ISSUES FOR FURTHER ANALYSIS

The introduction of the Unit Planning effort within the Forest Service represents a further refinement of the process of resource allocation. This process is not new in substance or intent, yet does provide for a new examination of the pruposes and goals of land use planning within the context of National Forest Administration. This report is, essentially, an overview review of this planning process and an attempt to discern both the applicability of economic analysis to the planning process as well as to outline in a brief fashion the framework within which economic analysis can hopefully contribute to the furthering of the allocation objectives. This report is neither a detailed examination of the Forest Service planning process[151] or a thorough treatment of the economic issues involved. Rather, it is hoped that this synthesis of the concepts of unit planning and economic analysis will stimulate further efforts to make planning more productive while increasing the contribution that economic analysis can make to the practicing resource manager.

Summary Findings

A review of the legal directives for Forest Service management and the specific language of the National Environmental Policy Act does not reveal specific requirements for explicit economic analysis for either unit planning or environmental impact assessment. However, this ambiguity with respect to specific requirements is greatly overshadowed by the oblique references to the use of economic analysis in almost all guidelines issued by the Council on Environmental Quality, the Forest Service, and the Courts through interpretation of NEPA requirements dealing with environmental impact statements. The current concept of "balancing" is essentially an

economic process - the formal consideration of tradeoffs between different and conflicting values. In spite of the nonspecific directives regarding economic analysis, there is little likelihood and future planning documents and/or environmental impact assessments will be judged adequate without substantial input based on economic analysis. This analysis will undoubtedly relate to both the questions of production economics (efficiency) and economic impact (distributional or equity considerations).

Without reliance on specific legal or policy requirements, it is evident that the major goals of small area unit planning can only be accomplished if the basic process is interpreted as a problem in the allocation of scarce resources; in short, the major focus of small unit planning is the evaluation of an economic problem. In the long run, it is improbable that acceptable solutions and land management policies can be developed without the input of economic analysis. Trial-and-error solutions will quite likely become more untenable in the face of increasing demands for the multiple outputs of the forest and the conflicts inherent in those demands. The process of expedient comprise between conflicting interests will, in all likelihood, result in increasing dissatisfaction on the part of all users. A clear recognition that difficult choices between conflicting interests need to be made and defended on the basis of rational analysis, and that all interests cannot be simultaneously satisfied in the forest any more than in the marketplace, needs to displace the subtle tendency to view planning as a means of eliminating conflict.

Before planning can proceed within an economic context, the problem of establishing explicit planning objectives needs to be carefully considered and resolved. This will undoubtedly affect all levels of organization within the Forest Service and ultimately depend upon action

by the Congress. It is unrealistic to expect the planning process to function as the arbitrator of resource allocation unless the goals and objectives to be accomplished are specific and amendable to measurement criteria. As has been well documented by Alston, this lack of specific analytical objectives remains one of the most significant problems in the analysis of Forest Service management policies and programs.(152)

The Forest Service, in part responsive to NEPA, has made a concerted effort towards greater public involvement in its decision-making process.(153) A clear focus, however, has not been detected with respect to the role that this involvement presumably will play. The "public" is highly diverse, and is unlikely to respond uniformly on any given issue. In contrast, public involvement is likely to be highly responsive to perceived costs and/or benefits potentially assignable to individuals and groups. As was noted in Part II of this report, policy decisions are normally made in the context of a means-end scheme which overlaps at each level of the Forest Service hierarchy. The goals at one level are often the means to goal accomplishment at a higher level. Public involvement is often viewed as a means to establish public goals for forest land management, and to arrive at a "concensus" about the direction of management programs. For example, the Forest Service Administrative Study concluded:(154)

> The three objectives (of public involvement) which the officers reported they most nearly achieved were 'make better resource management decisions that will have better public acceptance' (55%), 'determine the degree of public support for and interest in various management alternatives' (55%), and 'develop a good working relationship with the public that will carry over to future issues' (53%).

This statement of "objectives most nearly achieved" closely resembles the "Squeaking Wheel Principle" described by Gregory:(155)

> ...maximization of satisfaction, of social benefit, of present net worth, or of anything at all, is not the only possible goal for public land managers. One might venture that the apparent goal of at least some public land management is the minimization of dissatisfaction, and there is even considerable informal evidence to support the suggestion.

Public involvement is more likely to generate views and opinions on preferences for alternative product output mixes from forest management than to provide insights into the establishment of management objectives. The importnat point is that expressions from public involvement with respect to desired outputs and services does not constitute an expression of goals or objectives by which output decisions can be evaluated. The public are simultaneously stockholders in the public lands and users of the goods and services produced. Public involvement represents a dominant expression of user interests - either in favor of outputs desired by the individual or group or opposed to the shift of management output mix towards those outputs potentially in conflict with the interests of the individual or group.(156)

Production economics as a body of theory has a great deal to offer as a conceptual framework for interpreting the small area land use decision-making process. Resource managers are in a position of allocating increasingly scarce resources to alternative competing ends. Choices must be made which involve both the commitment of public resources (budgetary as well as land) for the provision of desired outputs. The public manager is therefore in the same position as any economic decision-maker with respect to decisions as to what to produce, what production methods to employ, what mix of outputs to produce, and how much of each output to produce. Further, he is faced with problems of allocating or rationing the available output among different claimants.

Production economics integrates the various elements of physical and biological production relationships, the tradeoffs between these relationships for alternate uses, and the implicit set of values established by society as a means of guiding optimal decisions over the use of resources. Implicit in the use of the production economics framework however, are several underlying requirements.

First, it is necessary to know the production relationship between inputs and outputs (in physical terms) for each of the several outputs under consideration. Further, it is necessary to know the joint production relationships between alternative outputs for a given level of resource investment. Finally, it is necessary to know the prevailing marginal social value of each of the outputs.

In practice, the resource manager faces significant problems in the application of traditional production economics. Problems noted include the proper definition of outputs in a manner consistent with both management functions and economic analysis. Without defined units of output, it is impossible to adequately consider the implicit tradeoffs between alternative resource output mixes. Given the identification of outputs, the manager also needs specific information on the production possibilities for his area of management authority. It is necessary to know with considerable detail the actual reduction in one output necessary for the increase in output of alternate outputs. The lack of this information is a major and significant weakness in current planning efforts. Attempts to generalize production information will likely be counter-productive. Although perhaps desirable for administrative purposes, it is unlikely that satisfactory generalizations can be established for major forest uses and their relationships given with wide scope of forest types

and conditions existing in the United States or even within a given region.

Given the production information noted above, and assuming satisfactory measurement of currently non-measured outputs, the manager additionally needs to explicitly consider the relevant marginal values associated with the potential outputs from his management activities. It is significant, although often ignored, that these values will be site specific. That is, the prevailing values will be conditioned by the location, access, quality and productivity of each forest unit. Representing a fixed land base, a forest unit is necessarily subjected to the demands for resource use as they exist within a defined market context. Hence, the selection of an economically optimal output mix for any given investment in management will undoubtedly differ, even for apparently similar management units, whenever demand factors differ for one or more of the goods or services involved. This is further evident when the production decision is enlarged to include the selection of the optimal level of management investment - i.e., the determination of the optimal use-mix combination along the production expansion path. Both the location of the expansion path, as well as the determination of the optimal combination on that path must be evaluated within the context of the specific planning unit.

Traditional production economics, to be helpful to the forest manager, must be modified to take account of currently nonmeasured benefits and costs. In part, this is related to the problem of output definition previously noted. The manager simply needs to know what the alternative outputs are that he is capable of producing. The problem has other dimensions, however. The production relationships, both for the individual commodity as well as for the joint production of the commodity together with other outputs, need to be defined in a meaningful manner. Finally,

measures of marginal value need to be developed within the context of the commodity units used and related to the costs incurred via other alternative outputs foregone. To date, the manager has little reliable information upon which to base production economic decisions (including both technical and value data).

Consideration needs to be given to a careful distinction between the concept of opportunity cost and the related but distinct concept of technical externalities. The concept of opportunity cost is basic to economic decisions, and is the underlying concept of cost analysis. The value of resources used in any production process is the value of alternative resource uses foregone. The fundamental issue in resource planning decisions is the correct identification of the actual values foregone. This is precisely where the concepts of production economics can be most helpful. Its application forces the decision-maker to be explicit in recognizing what the implications are of specific resource allocations.

Closely related to opportunity cost is the concept of technical externalities. In general, a technical externality represents an opportunity cost imposed on a third party which is likely ignored in conventional decision-making. Since the impact of the cost is imposed on someone else, it is unlikely to be weighed against benefits in the same manner as direct or explicit costs. Where such external costs are relevant, the true cost of a specific resource allocation will necessarily include, at the margin, both explicit budget costs, implicit opportunity costs, and external costs. Such an identification of relevant costs can then be compared with the appropriate marginal resource value. This is precisely the goal of production economics whereby the marginal rate of product substitution is

equated to the ratio of marginal values. Hence, when the allocation problem is correctly formulated, and appropriate modifications are made in recognition of non-measured benefits (values) and costs, the production economics framework can help focus decision-making on the relevant economic factors.

In constrast with the use of the production economics framework to assist managers in reaching socially optimal resource allocation decisions, economic impact analysis has as its main objective the description of the distributional or equity consequences of such decisions. It is important that these two fundamentally different objectives of economic analysis be kept separate. Without such a distinction, it is easily assumed that either they are the same thing or that the results of an impact analysis alone are sufficient to guide efficient allocation decisions. As has been noted in Part II, the use of impact analysis does not and cannot justify particular allocations. Where a reasonably competitive economy exists, the secondary and/or induced effects of a decision represent redistributions of economic welfare and activity from one region to another or from one set of economic sectors to another. While such redistributions are of primary interest for many purposes, including analysis of regional development, they fail to reveal the economic consequences of allocation decisions from an efficiency standpoint.

One limiting factor in impact analysis is the selection of the appropriate economic region to be studied. Since the purposes of impact analysis are to evaluate the redistributional consequences of resource allocation, there can be no "best" region. Problems of data availability, sector definitions and similiar constraints undoubtedly dictate the region to be used in specific instances. Where the impacts of resource decisions can be expected to be skewed nationally (eg: primary benefits generated

locally, primary costs borne nationally), a very limited interpretation of economic impact will be obtained. A high contribution to the local or regional economy may be generated at considerable expense to national economic units. Impact analysis simply reveals the interaction effects within some geographical boundary. Costs or benefits extending beyond the region are ignored - they comprise someone else's impact.

Related to the limitations imposed by geographical definitions are problems in the development and use of economic multipliers. Many of these problems have been noted by Flora.(157) In spite of apparent similarity, most small economic areas have a unique economic structure, necessitating careful examination of the economic interdependencies on a case-by-case basis. Problems also exist in terms of translating traditional economic output multipliers into comparable multipliers for either income or employment.

In the case of income, substantial assumptions must be made regarding the distribution of value added (income) within the region and the marginal spending propensities of each sector. With progressively smaller areas, these respending assumptions become more critical, since it is the spending within the area that determines the income multiplier. Further, and recognizing that the income flow generated is related to pecuniary impacts, it is tempting to assume that increased income represents a net economic benefit from an efficiency standpoint. While greater income is certainly preferable, at least from the local perspective, it does not constitute a net benefit in terms of project or management efficiency.

Closely related to the problems of income, additional limitations exist with regard to derivation of employment multipliers. Whereas income multipliers assume that an aggregate increase in income occurs, employment

multipliers attempt to assign that additional income to individuals, or more specifically, to employment opportunities. The interpretation of such multipliers is extremely difficult. For example, a sawmill may increase ouput through the employment of additional workers. Alternatively, it may increase its output simply by using existing employees on an over-time basis. Likewise, a reduction in output can result in either fewer employees or simply "underemployment" of the existing labor force by working at less than full capacity. In either case (increase or decrease in output) the resulting change in income can represent a change in the number of wage earners in the area or a change in the level of income for a constant work force. The income flow within the community will quite likely differ depending upon which situation occurs.(158) Simple income multipliers do not normally reveal the implicit assumptions that were made in their construction.

When considering income or employment multipliers in a dynamic sense, additional problems are raised. The most troublesome, and controversial, relate to assumptions about labor productivity. For example, a particular economic sector may be experiencing long term increases in labor productivity which imply less labor per unit of output. In such a situation, a reduction in <u>future</u> output of a particular commodity will result in a smaller employment impact than that same change in output would represent at present.(159) Further difficulty results in the identification of marginal labor productivity rather than averages. Finally, as noted at several points, such measures need to be specific to the location or area concerned. Substantial differences can exist within individual geographic regions or states.(160)

An additional finding that needs to be emphasized as a result of this review is what may be termed the conflict betwen "big" and "small" decisions.

One of the expressed concerns throughout much of the literature of resource decision-making is the presumed conflicts that result if goals and policies are set at a "high" level within an organization and imposed as constraints on management options and flexibility at the local level.(161) In recognizing the necessity of adopting management decisions that reflect the unique set of resource parameters and economic demands that exist on the ground for each specific area, it is easily understood why such fears exist. Yet, there is a countervailing concern that decentralized decision-making will result in the "tyranny of small decisions".(162) In this view, localized decision-making can result in suboptimization in that when disaggregated decisions are implimented they may not sum to the same pattern of resource use that would prevail with more comprehensive central planning.(163)

The above concerns can be logically interpreted within the framework of production economics discussed in this review. The problems relate to two fundamental issues: (1) currently non-measured outputs may be slighted in management decisions relative to more traditional commodity outputs, and (2) relative marginal values may not exist to guide the optimal choice of outputs even when the outputs are recognized in the consideration of alternatives.

In the former case, the non-measured outputs may be systematically excluded from consideration on the assumption that they are either irrelevant or will be produced elsewhere. The commonly expressed fears of "nibbling away" at the remaining wilderness, since at the margin each decision affects such a small part of the total, reflect the view that such "small" decisions will result in a significant reduction in the total wilderness acreage. In other words, each small area planner may make the

erroneous decision that his management plans can be evaluated in the absence of consideration of concurrent similar decisions made elsewhere.

In the latter case, the relationship between output at the unit planning level and the national market presumably can result in individual planning decisions jointly shifting market supply to a sufficient degree so as to induce significant changes in marginal social value. In this case, the relative values used to derive the unit planning decision may prove to be inaccurate simply because of the market-induced shift resulting from the composite of all such decisions.

Modifications in traditional methodology for production economic analysis can largely remedy the first area of concern. Recent guidelines issued by both the Council of Environmental Quality[164] and the Forest Service[165] give recognition to the need to consider non-measured outputs and "intangibles" on an equal basis along with market-oriented commodities. The development of appropriate techniques and criteria for accomplishing this modification has been specifically assigned to each Federal agency by the National Environmental Policy Act. Section 102(B) of NEPA states that each Federal agency shall:[166]

> Identify and develop methods and procedures, in consultation with the Council on Environmental Quality...which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations.

These guidelines are explicitly directed to broadening the consideration of production-output decisions so as to take into account all meaningful values to society whether they are currently expressed in the marketplace or not. If these guidelines are followed, there is little reason to believe that significant values will be ignored in small area land use planning decisions. This will, of course, require substantial compliance

with the directive to develop measures of the appropriate values.

The second concern - suboptimization and supply-induced shifts in marginal value - is difficult to evaluate without identifying several components of the problem. First, it needs to be emphasized that the vast majority of resource allocation decisions are made by the extreme in "small decisions" through individual choice in the marketplace. The basis for an exchange economic system fundamentally depends on the infinite complexity of such incremental decisions. It is perhaps surprising to find that in the public arena such incremental decision-making is suspect at best and often view as a threat to the optimal allocation of resources. In discussing public decision-making, Thompson has stated:(167)

> A more radical proposal for simplifying the task of making rational decisions is the doctrine of incrementalism suggested by the economist Charles E. Lindblom.
> .....
> The central notion of incrementalism is that choice is marginal. We should consider only incremental changes (small differences) from the present conditions or "system state". To go beyond this would be foolish because we do not have the knowledge to predict the outcome, and we couldn't get agreement on the ordering of the many values involved.

He further states:(168)

> Decision making is serial or continuous - continuous attacks on a permanent but changing problem within the jurisdiction of a particular decision maker or decision-making unit. Problems are not solved; they are alleviated.

The concept of incremental planning can be expected to be reasonably effective and efficient when viewed within the context of dynamic equilibrium systems. Only where planning takes place within the context of a system in an essential state of disequilibrium will significant suboptimization potentially occur. The vast majority of small area decisions will represent marginal or incremental adjustments in the "system state" as referred to by Thompson. Hence, major repercussions in terms of changing

marginal resource values will play a minor role. This is not to argue, however, that such repercussions should be ignored where a reasonable potential for market disruption is shown to be likely. Nor is it proposed that all planning takes place within the context of a dynamic equilibrium system.

To adequately deal with the first possibility - market disruption - a sequential planning process is necessary whereby tentative allocation decisions can be aggregated with a feedback from higher levels to test the validity of the planning assumptions and value estimates used. The imposition of higher level output constraints is not a necessary requirement - rather, the feedback mechanism will permit readjustment of planning assumptions and values and a redetermination of relative output mix where appropriate. Through a series of iterations, such adjustments should avoid major problems of market disruption as the inadvertent consequence of small area decisions.

The second issue - disequilibrium planning - should be viewed as a transitional possibility - and perhaps a real possibility in light of the necessity for recent guidelines for broadening the consideration of resource values.(169) The focus on revised procedures to assure consideration of non-market outputs, to include non-market costs, and to "balance" resource use indicates that there has been a general presumption of disequilibrium in outputs in National Forest management. As adjustments are made, and reallocations of resources accomplished, some shifts in market equilibrium values can be expected. However, it is precisely these changes in marginal values, both in the short run and the long run, that can guide small land use planning towards a system of "equilibrium planning", by continually indicating changes in the relative scarcity of alternative forest uses.

Issues for Further Analysis

On the basis of this overview, several major topics have been raised which merit further exploration and research by forest economists. While only the outline of the problems have been discussed here, much more research effort needs to be carried out before the conceptual models of the economist can be translated into working tools for the land manager. The major issues are enumerated briefly below:

1. Definition of Management Objectives

Economists have often concluded that the problem of management objectives needs to be resolved before useful analysis can proceed. Some have stated that such specification of objectives is a political rather than economic matter and implicitly assign the task to Congress or the "public". Others, such as Alston, attempt to derive analytical objectives from the fuzzy pronouncements of the Congress and others. Nevertheless, the forest economist can hopefully make a contribution to the formulation of objectives in a manner useful for both political and analytical purposes. Such a formulation needs to recognize the heirarchy of ends-means existing throughout an organization such as the Forest Service. The economist's goal of "maximize net social value" needs to be translated into meaningful goals at each level of decision-making. Finally, the goals need to be specific to the decision authority delegated to each decision-maker. The goals of the Chief need not and should not be stated the same as the goal of the District Ranter. While goals need to be compatible and consistent, they need not be identical. What is important, is that the goals be adaptable to both management functions and economic analysis.

2. Definition of Management Outputs

The analysis of mangement decisions rests with knowledge of output alternatives. The economist can hopefully make a significant contribution through assisting in the definition of meaningful measures of output. The use of such measures of output as acre-feet of water or visitor days of recreation leaves much to be desired for purposes of economic analysis. The economist is in a position to shape more meaningful measures of output as a preliminary step to the application of economic concepts to resource planning.

3. Specificaiton of Joint Production Functions

Physical and biological research in forest management has traditionally resulted in production information ill-suited to the needs of economic analysis. Economic research devoted to specifying the needs of basic production function data and more importantly the framework for joint production relationships would assist in making basic forest research more productive and useful from the standpoint of specific small area land use decision-making. The decision-maker is now faced with attempting to fit data and information on production output relationships developed for other purposes into a completely different framework. Interdisciplinary research to reorient studies of production relationships could help assure a better data base for future small area planning.

4. Identification of Resource Values

A major gap in the application of production analysis is the unsatisfactory state of knowledge with respect to relevant resource values. First, a fundamental distinction needs to be established between the range of technical production alternatives, on the one hand, and the value criteria for choosing between those alternatives on the other. Secondly, forest

economists need to stress the importance of establishing marginal values as the appropriate allocation criteria and avoid the sterile debate on measures of aggregate value (worth?) of given projects or outputs. The decision-maker needs to know whether a little more or a little less of a given output is desirable considering his alternatives.

A reorientation away from total value analysis toward marginal value estimation can help simplify the problems of estimation methodology. When all outputs are recognized as "economic" goods (even in the absence of market allocation) the underlying concepts of demand behavior can be useful in focusing on those factors that shape marginal demands for outputs in specific resource markets.

5. Measurement of Technical Externalities

Much has been said about potential technical externalities in forest land management. These range from the consideration of environmental factors such as air and water pollution to intertemporal impacts such as the effects of current timber production on the future productivity of forest lands for the production of future timber crops. The general impression is that much of this discussion is speculative or at best based on limited research. A fruitful area for research in forest economics would be the isolation and identificaiton of presumed technical externalities and the quantification of their economic relationship to current management activities. For example, slash disposal policies often presume technical externalities including impact on future forest protection operations, future logging conditions, impact on regeneration, and so forth. To the extent that such externalities exist (either positive or negative) they should be included in the anlysis of current operations. This is virtually impossible to do to date.

6. Analysis of Regional Economic Structure

Impact analysis depends on the identification of a relevant economic region and the subsequent investigation of the interdependencies within that region. Yet very little is currently known about the structure of the economy in small areas and the similarities and/or differences relevant to impact assessment. A program of comparative analysis of small area economic base structure may reveal priority elements of concern to facilitate future impact assessment. At present, most such assessments depend upon preexisting studies, often of other areas or of different geographical scope, or require original research on a unit-by-unit basis. The identification of key structural relationships may provide the ability to focus specifically on critical local economic factors yet utilize existing information with respect to the broader economy of a state or region. "Forward" impact methodology also needs further development.

7. Analysis of Labor Trends and Productivity

A continuing investigation of the key conceptual issues related to labor productivity, indicators of changes in productivity, and trends within small areas could contribute greatly to the validity of impact assessment studies. Closely related to such an effort would be the analysis of local income generation as a result of land use decisions. The two key elements of economic impact assessment are employment and income. Yet very little conceptual research has been undertaken to relate these key considerations to land management options. The current level of controversy attests to the unsatisfactory level of understanding of these issues.

8. Synthesis of Economic Analysis and Policy Decision-making

The final concern generated through this review of small area land use planning efforts is the apparent separation of economic analysis from the policy decision-making process. Economic analysis is perhaps employed more for justification of policy decisions than for the purposes of assisting in making those decisions. The role of economics in planning has been summarized by Hitch and McKean in the following manner:(170)

> The essence of economic choice in...planning is not quantitive analysis; calculation may not be necessary or useful depending upon the problem and what is known about it. The essential thing is the comparison of all the relevant alternatives from the point of view of the objectives each can accomplish and the costs which it involves; and the selection of the best (or a 'good') alternative through the use of appropriate economic criteria.

Economic analysis, in the end, is a way of viewing the problem of land use allocation. Perhaps the greatest contribution that forest economics can make to the problem of small area analysis is through integrating the understanding of the fundamental nature of economic decision-making into everyday consideration of management options.

Footnote References

[1]National Environmental Policy Act of 1969, Public Law 91-190, 91st Congress, S.1075, January 1, 1970.

[2]Forest Service Manual 2120.

[3]Forest Service Manual 8220, Draft Copy.

[4]Forest Service Manual 8227.

[5]Marion Clawson,"How Much Economics in National Forest Management?", Journal of Forestry, January 1974, pp. 13-16.

[6]National Environmental Policy Act of 1969, loc. cit.

[7]Fredric R. Anderson, NEPA in the Courts-A Legal Analysis of the National Environmental Policy Act, Resources for the Future, Washington, D.C. 1973.

[8]Calvert Cliffs Coordinating Committee, Inc. V. Atomic Energy Commission, 449 F 2d 1109 (D.C. Cir., 1971), 2E.R. 1779, 1E.L.R. 20346.

[9]Anderson, op.cit, pp.247-256.

[10]Sierra Club vs. Froehlke, (Trinity River - Wallisville Dam), _____ F. Supp._____, 3ELR 20248 (S.D. Tex. 1973).

[11]Council on Environmental Quality Memorandum to Federal Agencies, May 16, 1972, in Environmental Impact Statement Guidelines, prepared by E.P.A. of Region X, Revised Ed., April 1973, Attachment D.

[12]Federal Register, Wednesday, August 1, 1973, Vol. 38(174) Part II

[13]Cover letter, ED.1, Nov.9, 1971.

[14]FSM 8213.07.

[15]FSM 8213.08.

[16]FSM 8227.43 (Public Needs in Unit Planning) specifically states: "Economics and social considerations are important elements in decision making".

[17]Richard M. Alston, Forest Goals and Decisionmaking in the Forest Service, U.S.D.A. Forest Service Research Paper INT-128, Sept. 1972.

[18]The hierarchical levels of authority of the Forest Service Land Use Planning system include: (1) National objectives and targets established by the Chief of the Forest Service and the Secretary of Agriculture subject to review of Congress, (2) Direction issued by the Regional Foresters including Area Guides, (3) Forest Supervisor combines the planning direction received

from the Regional Forester with specific information about the forest to formulate a Forest Land Use Plan, and (4) Unit Plans which actually determine land use allocations in accord with National, Regional, Forest, and Unit Plan objectives. See FSM 8216.

[19]B.L. Driver (Ed.), "Some Thoughts on Planning, the Planning Process and Related Decision Processes", Elements of Outdoor Recreation Planning, University Microfilms, University of Michigan, 1970, p.214.

[20]F.S.M. 8210

[21]Ibid.

[22]Albert C. Worrell, Principles of Forest Policy, McGraw Hill Book Company, New York, 1970, p. 11.

[23]R. Duane Lloyd, "Economics of Multiple-Use", in Proceedings of Conference on Multiple Use in Southern Forests, Pine Mountain, Georgia, November 1969, pp. 45-54.

[24]This objective, as stated by Worrell is clearly not an explicit statement of an objective that this presentation deems necessary. For example, it is not clear what is implied by "adequate". A more precise formulation may be to state that the objective of society is to maximize the supply of wood subject to constraints resulting from other established policies, or perhaps to minimize costs while producing a given output of wood. However, since this example is illustrative, it seems sufficient to merely point out this shortcoming.

[25]For example, see: C.A. Reich, Bureaucracy and the Forests. Center for the Study of Democratic Institutions, Santa Barbara, CA, 1962, and Willamette National Land Use Study, prepared by Western Environmental Trade Organization, Portland, OR, March 1974.

[26]For example, see: James E Bethune and James C Fortson,"Management Planning and Decision Making for Multi-Use". and Alston, op. cit., pp 10-35

[27]Alston, op.cit., p. 37

[28]It is interesting to observe that this objective for the National Forests was also suggested by the Public Land Law Review Commission. See Public Land Law Review Commission, One Third of the Nation's Land, A Report to the President and the Congress by the Public Land Law Review Commission, Washington, D.C., G.P.O., June 1970.

[29]Elizabeth A. Gardiner, "Public Investment Criteria: Application to a Project in the Souris River Basin", Agassiz Centre for Water Studies Research Report # 8, University of Manitoba, 1973.

[30]Ibid.

[31]FSM 8213.08

[32]Alston, op. cit., p. 36.

[33]Worrell, op. cit., p 14.

[34]Gardiner, op. cit.

[35]Coleman Woodbury, "The Role of the Regional Planner in Preserving Habitats and Scenic Values", Future Environments of North America, Ed. by F Fraser Darling and John P. Milton, The National History Press, Garden City, New York, 1966, pp 568-612.

[36]Lloyd, op. cit.,p 46.

[37]U.S. Department of Agriculture, Forest Service, "Framework for the Future - Forest Service Objectives and Policy Guides", February 1970, Government Printing Office (not paged).

[38]Loc. cit.

[39]Alston, op. cit., p 35.

[40]Draft Env. Statement for Salmon River and Roaring River Unit Plans, U.S.F.S., Mt. Hood National Forest, June 1973, p. 8

[41]For example, see: Clawson, Loc. cit.

[42]Lloyd, op. cit., p. 46.

[43]For a further discussion of this issue, see Alston, op. cit., and Clawson, op. cit.

[44]Lloyd, op. cit., p. 48.

[45]For a detailed discussion of this economic interpretation of production functions, see William J Baumol, Economic Theory and Operations Analysis, 3rd Ed., Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1972, Chapter 11.

[46]G Robinson Gregory, "An Economic Approach to Multiple Use", Forest Science, 1(1):6-13, March, 1955.

[47]Budget levels are also assumed at a fixed level. Variations in budget levels will shift the production relationship and will be discussed subsequently.

[48]Gregory, op. cit.,Forest Science, 1955, p.7.

[49]This terminology follows that used by Lloyd, op. cit.; See also G. Robinson Gregory, Forest Resource Economics, Ronald Press, 1972, Chapter 13.

[50]For a further discussion of this concept, see Gregory, loc. cit.

[51]In this case, the point where the marginal rate of substitution is equal

to the ratio of the marginal values of the two products must necessarily be located in the competitive portion of the curve. For an applied example of this, see: Cook, C. Wayne, "Common Use of Summer Range by Sheep and Cattle", J. Range Mgt., 7:10-13, 1954.

[52]G. Robinson Gregory, "An Economic Approach to Multiple Use", Forest Science, 1(1):8- 9, March 1955

[53]Since these slopes are the marginal cost and marginal value functions, the point where total net value is at a maximum is where marginal lost equals marginal value.

[54]Lloyd, op. cit., p. 48.

[55]Even purity of water has several aspects. For example, biologists often classify purity into five different types: (1) putrescible materials, (2) heated effluent, (3) toxic materials, (4) inert materials, and (5) radioactive elements or compounds. See, M.I. Goldman and R. Shoop 1967. "What is Pollution", in Controlling Pollution, ed. M.I. Goldman, Englewood Cliffs, N.J.

[56]Gregory, Forest Resource Economics

[57]F. Bell and M. Kirby, An Overview of a Study in Program Budgeting on a National Forest, U.S.D.A. Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.,1970.

[58]Clawson and Kneten raise questions as to the adequacy of the measures in determining the actual quantity of recreation consumed when considering the qualitative aspects and intensity of use for various types of recreation. Marion Clawson and Jack L. Knetsch Economics of Outdoor Recreation, Johns Hopkins Press, 1966, pp 167-170.

[59]See J. Alan Wagar, "Recreational Carrying Capacity Reconsidered", Journal of Forestry, May 1974, pp 274-278.

[60]G Robinson Gregory, Forest Resource Ecnomics, p. 492.

[61]For further discussion of this issue see: Gregory, G.R., Forest Resource Economics, the Ronald Press, New York, 1972, and George R Hall, 1963, "The Myth and Reality of Multiple-Use Forestry", Natural Resources Journal, 3:276-290.

[62]Bell and Kirby, op. cit.

[63]Gregory, "An Economic Approach to Multiple Use", p 7.

[64]This is obvious when one recalls that the economically optimum mix of products occurs where the marginal rate of substitution between alternative products is equal to the value ratios of the products. See footnote 9.

[65]For example, see discussion in: Jack L Knetsch, "Problems of appraised Recreation Demand", Conference Proceedings of the Committee on the Economics of Water Resources Development of the Western Agricultural Economic Research Council, Report #13, San Francisco, CA., 1964, p. 42.

[66]This point has been pointed out in some detail by M. Clawson, Methods of Measuring the Demand for and Value of Outdoor Recreation, Resources for the Future, Inc., Reprint #10, Wash., D.C., 1959, p. 3. Clawson concludes that the only distinction between outdoor recreational services and many others stems from only the extra-market nature of these services. It is perhaps belaboring the point to indicate that many products are exchanged on the market largely because of their aesthetic content or some other characteristic which makes consumer evaluation highly subjective. Yet economic evaluation of these goods and services is accepted without debate.

[67]Lawrence G Hines, "Measurement of Recreational Benefits: a Reply", Land Economics, November 1958, pp 365-67.

[68]Jack L Knetsch, "Problems of Appraised Recreation Demand, op. cit., p. 43.

[69]J.W. Milliman, "Policy Horizons for Future Urban Water Supply", Land Economics, May 1963, pp. 109-132

[70]Robert K. Davis, "Recreation Planning as an Economic Problem", Journal of Natural Resources, October 1963, pp 329-249.

[71]This viewpoint permeates the economic literature on the subject of non-market value measurement; For example see: Jack L. Knetsch, "Problems of Appraised Recreation Demand", op. cit; M. Clawson, "Methods of Measuring the Demand for and Value of Outdoor Recreation, op. cit.; Jack L Knetsch, "Outdoor Recreation Demands and Benefits", Land Economics, November 1963, pp. 387-396; and David W. Seckler, "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation", Land Economics, November 1966, pp. 485-494.

[72]Jack L. Knetsch, "Value Comparisons in Free-Flowing Stream Development", Natural Resources Journal, Vol II, No. 4, October 1973, p. 625.

[73]P. Davidson, F.G. Adams and J. Seneca, "The Social Value of Recreational Facilities Resulting from an Improvement in Water Quality", in Water Research, (A.V. Kneese and S.C. Smith, Eds.) The Johns Hopkins Press, 1965, pp. 183-184.

[74]Ibid. p. 183-184

[75]External diseconomies occur when all of the costs of producing (or consuming) outputs are not borne directly by the producers (or consumers). These are frequently called externalities, or spillover effects.

[76]For example, see: M Clawson and Jack L Knetsch, Economies of Outdoor Recreation, op. cit., p. 275.

[77]This terminology was used by John V Krutilla, "Efficiency Goals, Market Failure, and the Substitution of Public for Private Action", in The Analysis and Evaluation of Public Expenditures: The PPB System, The Joint Economic Committee Print, U.S. Gov't Printing Office, 1969, p. 284.

[78]Krutilla, Ibid., p. 284

[79]F.N. Bator, "The Anatomy of Market Failure," Q.J.E., Vol. 72, August 1958, pp. 365-371.

[80]In the case of public goods, once the good is produced, the marginal cost of providing the good for consumer use would be zero. Therefore, the economically efficient market price, which is determined by the equality of marginal cost and marginal value, would also be zero. For the case of technical externalities, the marginal cost would presumably not incorporate all of the costs actually incurred in providing (or consuming) the product. Therefore, a market determined price would be low relative to a market determined price in the absence of such externalities.

[81]Bator, op. cit. pp. 365-371

[82]"Willamette National Forest Land Use Study", Western Environmental Trade Association, March 1974, pp. 69-70.

[83]N.Kalder, "Welfare Propositions in Economics and Interpersonal Comparisons of Utility", Economic Journal, 1939.

[84]Jack L Knetsch, "Financing Public Outdoor Recreation", Proceedings, National Conference on Policy Issues in Outdoor Recreation, Logan, Utah, September 1966.

[85]That is, the relative marginal value of an output characterized by nonvalued or incompletely valued benefits cannot be accurately reflected in a value (price) ratio line without explicit modifications of market based indicators.

[86]Roland N. McKean, Efficiency in Government Through Systems Analysis, John Wiley and Sons, Inc., New York, 1958, p. 127, pp. 206-208, 240-242.

[87]Arthur Maass and Maynard M Hutschmidt, Design of Water Resources Systems: New Techniques for Relating Economic Objectives, Engineering Analysis, and Government Planning, Harvard University Press, Cambridge, Mass, 1962, pp. 62-86.

[88]Ibid. Where there are "N" groups of noncommensurate benefits, minimum levels must be set for (n-1) of them and the remaining one benefit maximized subject to these (n-1) constraints. The reader should recognize this as basically the principle involved in mathematical linear programming.

[89]Otto Eckstein, "A Survey of Public Expenditure Criteria", Public Finance: Needs, Sources and Utilization, Universities-National Bureau Committee on Economic Research, Princeton University Press, 1961, p. 445.

[90]Ibid., p. 445.

[91]A. Myrick Freeman III, "Project Design and Evaluations with Multiple Objectives", in The Analysis and Evaluation of Public Expenditures: The PPB System, Joint Economic Committee Print, U.S. Gov't Printing Office, Wash., D.C., 1969, pp. 565-578.

[92] For a more indepth discussion of these and other techniques at qualifying non-market goods, see Nicholas H Coomer and Asit K. Biswas, Evaluation of Environmental Intangibles, Genera Press, Bronxville, New York, 1973.

[93]Julius Margolis, "Shadow Prices for Incorrect or nonexistent Market Values", in The Analysis and Evaluation of Public Expenditures: The PPB System, Joint Economic committee Print, U.S. Govt. Printing Office, Wash., D.C., 1969, p. 541.

[94]For a more detailed discussion of this concept of willingness to pay, see: Jack L. Knetsch, "Value Comparisons in Free-Flowing Stream Developmen Natural Resources Journal, Vol. 11, No. 4, October 1971, pp. 264-635.

[95]Jerome W. Milliman, "Beneficiary Charges and Efficient Public Expenditure Decisions", in The analysis and Evaluation of Public Expenditures: The PPB System, Joint Economic Committee Print, U.S. Govt Printing Office, Wash. D.C., 1969, pp. 291-318.

[96]R.A. Prewitt, The Economics of Public Recreation: An Economic Study of The Monetary Evaluation of Recreation in the National Parks, Land and Recreational Planning Division, National Parks Service, Wash., D.C., 1949.

[97]M. Clawson, Methods of Measuring the Demand for and the Value of Outdoor Recreation, RFF, Inc., Reprint No. 10, 1959.

[98]Coomer and Biswas, op. cit., p. 12.

[99]Ibid., pp.13-18

[100]Ibid., p. 24

[101]P.H. Pearse, "A New Approach to the Evaluation of Non-Priced Recreational Resources", Land Economics, Vol. 44, 1968, p. 91-92.

[102]James A Crutchfield, "Evaluating Fishery Resources", Land Economics, Vol. 38, No. 2, Mary 1962, p 151. See also: Paul Samuelson, "Why Consumer's Surplus is Superfluous", Foundations of Economic Analysis, Atheneum, 1965, pp. 195-202.

[103]Coomber and Biswas, op. cit., p. 26.

[104]M.M. Kelso, "Economic Analysis in the Allocation of the Federal Budget to Resource Development", Economics and Public Policy in Water Resource Development, (Ed. Stephen C. Smith and Emery H. Castle) Iowa State University Press, Ames, Iowa, 1964, p.70.

[105]Ibid., p. 70

[106]Jack L Knetsch, "Value Comparisons in Free-flowing Stream Development", Natural Resources Journal, Vol II (4) October 1971, pp. 624-635.'

[107]See Roland N McKean, "The Use of Shadow Prices" in Samuel B Chase, Jr. (Ed) Problems in Public Expenditure Analysis, The Brookings Institution, 1968, pp 35-65. (also discussion by Allen V Kneese, pp. 65-71).

[108]Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation, op. cit., p. 224

[109]Coomer and Biswas. op. cit., p. 30.

[110]M. Clawson, Methods for Measuring the Demand for and value of Outdoor Recreation, Resources for the Future, Inc. Reprint No 10, 1959.

[111]Clawson and Knetsch, "op. cit., p. 225.

[112]Outdoor Recreation Resources Review Commission, Economic Studies of Outdoor Recreation, Study Report 24, M. Clawson, Al. Moore, I.M. Lee, Washington, D.C., 1962.

[113]U.S. Fish and Wildlife Service, Report of the Panel on Recreational Values for Recreation Aspects of Fish and Wildlife, Subcommittee on Evaluation Standards, Interagency committee on Water Resources, May, 1960.

[114]Clawson and Knetsch, op. cit., p. 226.

[115]James A Crutchfield, "Valuation of Fishery Resources", Land Economics, May 1962.

[116]R.A. Prewitt, The Economics of Public Recreation: an Economic Study of the Monetary Evaluation of Recreation in the National Parks, Land and Recreational Planning Division, National Park Service, Washington, D.C., 1949, p.20.

[117]This point was brought out by Coomer and Biswas, op. cit. p. 30.

[118]Clawson and Knetsch, op. cit., p. 226.

[119]"Policies, Standards, and Procedures in the Formulation, Evaluation, and Review Plans for Use and Development of Water and Related Land Resources", 87th Congress, Second Session, Senate Document 97, approved May 1962; "Evaluation Standards for Primary Outdoor Recreation Benefits", Supplement No.1, Ad Hoc Water Resources Council, Washington, D.C., June 1964.

[120]Clawson and Knetsch, op. cit., 1966, p. 227.

[121]See "Comments" by Allen V Kneese in Problems in Public Expenditure Analysis, the Brookings Institution, 1968, pp 65-71.

> "I have felt particularly uneasy about the recent rash of economic studies which endeavor to insert an explicit income redistribution value in public project evaluations....
>
> "What I really fear is that many projects which are both ineffluent (in the economist's sense) and poor vehicles for income distribution will be found justifiable on income distribution grounds because they will not be viewed in the context of all the approaches potentially available". (p. 66).

[122]Tibor Scitovsky, "Two Concepts of External Economies", Journal of Political Economy vol 62 (April 1954) pp 143-151 reprinted in Externalities, Robert Staaf and Frances Tannian, (Ed), Dunellen Publishing Company, Inc. (n.d.) pp. 77-86.

[123]See William K Kapp, "On the Nature and Significance of Social Costs", Kyklos, vol XXII, 1969, pp 334-347, and Howard S Ellis and William Fellner, "External Economics and Diseconomies", American Economic Review, Vol 33, Sept 1943, pp. 493-511.

[124]Scitovsky, op. cit., pp. 80-81.

[125]Jack Hirshleifer, James C DeHaven and Jerome W Milliman, Water Supply, Chapter IV, "Criticisms of Market Allocations: The Political Allocation Process", The Univ. of Chicago Press, 1960 (pp 74-82). See also: Otto A Davis and Morton I Kamien, "Externalities, Information, and Alternative Collective Action", in Robert Dorfman and Nancy S Dorfman, Economics of the Environment, W.W. Norton and Company, 1972 (pp 69-87).

[126]Jack L Knetsch, et al., "Federal Natural Resources Development: Basic Issues in Benefit and Cost Measurement", Natural Resources Policy Center, The George Washington University, Wash. D.C., May 1969, pp 4-6.

[127]Otto A Davis and Morton I Kamien, op. cit., p 74.

[128]U.S. Department of Agriculture, Economic Research Service, Proceedings of a Symposium, Secondary Impacts of Public Investment in Natural Resources, September 25-27, 1968, Miscellaneous Publication No 1177. August 1970.

[129]Gary C Taylor, "Relating Economic Evaluation of Federal Resources Programs to Political Objectives and Social Values", in Economic Research Service, op. cit., p. 14.

[130]Berl F. Long, "Concepts and Theoretical Basis for Evaluation of Secondary Impacts", in Economic Research Service, op. cit., p. 18

[131]Ibid., p. 19.

[132]Ibid., p. 18

[133]See Frank J. Convery, "Unit Planning and Local Economic Impacts of Alternative Forest Management Practices", Technical Paper No. 1, School of Forestry, Duke University, Durham, North Carolina, Fall 1973, pp. 5-7.

[134]For a recent review of forestry literature see William McKillop, "Secondary Impacts of Intensified Timber Management Programs", report for Division of Forest Economics and Marketing Research, Forest Service, U.S. Department of Agriculture, Wash., D.C., August 15, 1973, pp. 16-25.

[135]For a basic discussion of economic base analysis, see Charles M. Tiebout, The Community Economic Base Study, Supplementary Paper No 16, Committee for Economic Development, New York. Dec. 1962.

[136]See Wilbur R Maki and Dennis L Schweitzer, "Importance of Timber Based Employment to the Douglas-Fir Region, 1959-1971", U.S. Dept of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Research Note PNW-196, June 1973.

[137]For a basic discussion of Input-Output analysis, see William H Miernyk, The Elements of Input-Output Analysis, Random House, New York, 1966. For a more technical treatment see Yan, Chiou-Suang, Introduction to Input-Output Economics, Holt, Rinehart and Winston, 1969.

[138]For an example of the application of Input-Output analysis to resource management policy situations, see Galen Burghardt et.al., "Impact of Public Lands on Selected Regional Economies", a study prepared for the Public Land Law Review Commission by Consulting Services Corporation, Seattle, 1969. Many additional studies are cited by Convery, op. cit.

[139]See W. Leontief, Environmental Repercussions and the Economic Struture: An Input-Output Approach", Review of Economics and Statistics, vol 52 (3) 1970 and Converse, A.O., "On the Extension of Input-Output Analyses to account for Environmental Externalities", American Economic Review, Vol 61(1), March 1971, pp. 197-198.

[140]Walter Isard, Ecologic-Economic Analyis for Regional Development, The Free Press, 1972.

[141]James C Hite and Eugene A Laurent, Environmental Planning: An Economic Analysis, Praeger Publishers, 1972.

[142]See U.S. Office of the President, Bureau of the Budget, Standard Industrial Classification Manual, Government Printing Office, Wash., D.C. 1964.

[143]See Donald F. Flora, "The Total Economic Impact of Forest Land Withdrawals", Proceedings, Washington State Forestry Conference, 1967, p.35.

[144]Kienjiro Ara, "The aggregation problem in input-output analysis", Econmetrica, Vol 27, April 1959, pp. 257-62.

[145]For an effort to develop a complete analysis on a local area basis, see Russell C Youmans, et.al.,"Douglas County, Oregon: Structure of a Timber County Economy", Circular of Information 645, Agricultural Experiment Station, Oregon State University, Corvallis, OR., December 1973.

[146]See Burghardt, op. cit., Appendix B, pp. 197-204.

[147]Thomas R Waggener, "Estimating the Economic Impact of Changes in the Supply of Timber", Oregon Business Review, Vol XXXI (3-4) March-April, 1972.

[148]Ibid, p.3

[149]Ibid, p.2

[150]Miernyk, op. cit., pp. 46-48.

[151]For a recent review of the Unit Planning process and the integration of NEPA requirements and Multiple Use Planning within the Forest Service, see "Agency Decision-Making Processes: NEPA Integration in Planning Systems and Implementation Procedures Review", Working Paper No. 3, The National Environmental Policy Act Process Study: U.S. Forest Service and Bureau of Land Management, VTN Consolidated, Inc. Irvine, CA. Nov. 19, 1973.

[152]Richard M Alston, "Forest - Goals and Decisionmaking in the Forest Service", U.S.D.A. Forest Service Research Paper INT-128. Sept 1972, pp 10-34.

[153]See John C Hendee, et. al., "Public Involvement and the Forest Service: Experience, Effectiveness and Suggested Direction", A Report from the U.S. Forest Service Adminstrative Study of Public Involvement, May 1973.

[154]Ibid., p. 17

[155]G. Robinson Gregory, Forest Resource Economics, The Ronald Press Co., 1972, p. 405.

[156]Western Environmental Trade Association, "Willamette National Forest Land Use Study", Part I, p. 8-16.

[157]Donald F. Flora, "The Total Economic Impact of Forest Land Withdrawals", Proceedings, Washington State Forestry Conference, 1967, pp. 35-36.

[158]Charles M. Tiebout, The Community Economic Base Study, Supplementary Paper No. 16, Committee for Economic Development, 1962, pp. 65-67

[159]Brian R. Wall, "Employment Implications of Projected Timber Output in the Douglas-fir Region, 1970-2000", Forest Service, Research Note PNW-11, Nov. 1973.

[160]For a discussion of many of these problems see, Brian R. Wall, "The Role of the Pacific Northwest Forest and Range Experiment Station and the Need for Economic Impact Information", In-Service Memorandum to Melvin E. Medcalf and Donald R. Gedney, Nov. 28, 1972.

[161]See Arnold W. Bolle, "Report on the Bitterroot National Forest", Report of a Select Committee of the University of Montana, November 18, 1970, (Reprinted as Document 91-115, "A University View of the Forest Service", U.S. Senate, 91st Congress, 2nd Session, Dec. 1, 1970), pp. 25-27.

[162]Alfred Kahn, "The Tyranny of Small Decisions: Market Failures, Imperfections, and the Limits of Economics", Kyklos, Vol. 19, 1966.

[163]John V. Krutilla, "Conservation Reconsidered", American Economic Review, Vol. LVII(4), Sept. 1967. pp. 777-786

[164]Council on Environmental Quality, "Preparation of Environmental Impact Statements-Guidelines", Federal Register, Vol.38(147) Part II, pp. 20550-20562. August 1, 1973.

[165]U.S. Department of Agriculture, "Environmental Impact Statements - Proposed Guidelines", Federal Register, Vol. 38(222), Part II, pp.33922-35 Nov. 19, 1973.

[166]National Environmental Policy Act of 1969.

[167]Victor A. Thompson, "Decision Theory, Pure and Applied", General Learning Press, New York, 1971, p. 8.

[168]Thompson, Loc.cit.

[169]See Edward P. Cliff, "Forest Management-New Directions", Journal of Forestry, Dec. 1971, pp. 844-846.

[170]Charles J. Hitch and Roland N. McKean, The Economics of Defense in a Nuclear Age, Harvard University Press, 1960, p. 118.